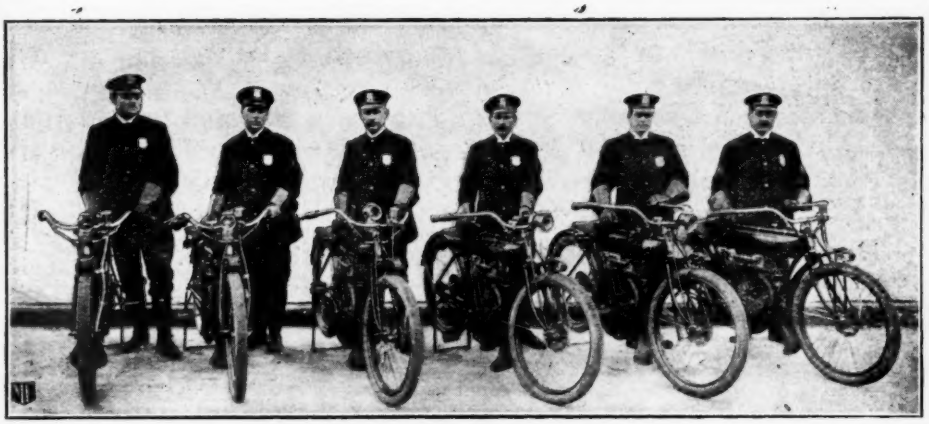
MUNICIPAL ENGINEERING

The World's Leading Municipal Publication.



A Police Squad Equipped with Motorcycles.

VOL. XLVIII. JANUARY, 1915. NO. 1.

The circumstances under which the great majority of appointments to positions in the municipal service have been made in this country have given rise to a theory very generally held that almost anybody could "fill a city job." A large percentage of our people are firmly convinced, for some reason which is not easily explained, that municipal service is different from private service and that a certain amount of common sense and a willingness to work are all the requisites that are needed to fill such a position efficiently. We have worked during this administration and in this department under an assumption that these by no means constitute all the requirements. We believe that municipal service has everything to gain and nothing to lose by accentuating the points in which it is like the service in private institutions, and by minimizing the importance of those things in which it differs from private undertakings.—Morris Llewellyn Cooke, Director of Public Works, Philadelphia, Pa.

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THE CLEANING OF WATER MAINS

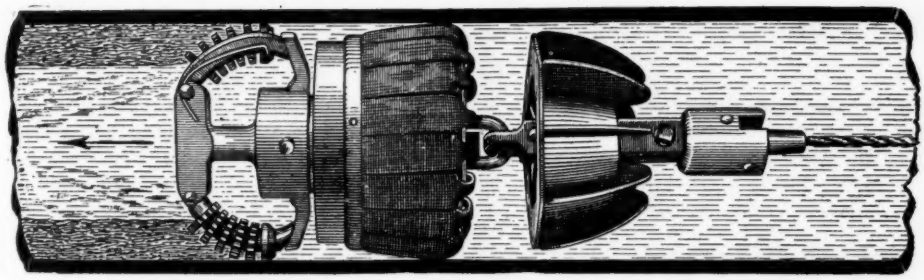
By J. F. Springer, New York City.

Cleaning of water mains is a difficult operation which was long considered too expensive for application. The reduction in capacity of mains at the same time with an increase in demand, has brought water works plants to the point of laying additional mains on the one hand or of cleaning the existing mains on the other. Methods of cleaning have developed slowly and have been reported from time to time for several years in MUNICIPAL ENGINEERING. *They have reduced the expense with the increase in efficiency. This article shows the principal methods now in use and the difficulties and expense to be met in cleaning systems of pipes not originally designed and constructed with facilities for subsequent cleaning.*

THERE are two distinct methods of cleaning the interior of a water main. One of these proceeds by dragging the cleaning device thru the pipe by means of a steel cable. The other operates by means of a cleaning machine which is carried thru the main by the force of the water. The cable system is used with very small pipe, from 3 to 6 inches diameter. For moderate sizes of pipe, from 6 to 10 inches, either system is applicable, while for still larger sizes the water-driven device is employed. These are general statements; particular conditions may impose some variation. In fact, in cases where the pipe is large and conditions in general indicate the water-propelled device, it will still be necessary to employ the cable system in the immediate vicinity of the reservoir where the pressure is either nothing at all or too low to furnish sufficient driving force.

The pipe system is laid off in sections which may vary from 50 feet in length to half a mile. Particular attention will be directed to making the sectional divisions at abrupt turns, the object being to avoid including them in the inaccessible parts of the pipe. An excavation will be made at each end of a section and portions of the main exposed. The length of pipe exposed at either excavation will vary from 2 to 6 feet or more, according to circumstances. The cleaning will be done in the direction of the flow of the water. The water will be turned off, but not until a length of pipe at each excavation has been diamond-pointed to a point within perhaps ⅛ inch of the thickness of the cast iron. These lengths will be entirely cut out after the shutting off of the water. Ditch pumps at the two excavations will take care of the dead water coming from the pipe. At the far end, looking in the direction of flow, a bend and straight length will be yarned in, the object being to provide a discharge end for the section of main that is now to be cleaned. The riser pipe will project obliquely above the surface. Up to this point, the general method of procedure is the same whether the cable system of cleaning is employed or that which uses the water-propelled machine.

Assuming that we are proposing to use the cable, we must now go ahead and get it thru the section of pipe. A winch with perhaps half a mile of steel rope is set up at each end of the section. At the near end the rope will be small, say 3/16 inch in diameter; at the far end, larger, say ⅜ inch in diameter. At the near excavation, either a special hatch box will be put in



TURBINE *machine for cleaning water mains. The water pressure from the left forces the machine thru the pipe. The revolving cutters in front scrape off the encrustations on the pipe, and water, let thru adjustable openings in the piston, revolves the cutters and forces the debris forward. The cord at the left serves to locate the machine if it is stopped for any reason.*

place of the short length of pipe removed, or else a piece of ordinary pipe together with a sleeve will be arranged. A special device is put into the hatch box or arrangement of pipe. This is known as the carrier. Its function is to transport the end of the small rope thru the section of main. The rope is passed thru a stuffing box or perhaps thru a simple hole into the pipe and there secured to the carrier. When these arrangements have been made and the connections are found to be sufficiently tight, the water is turned on. The carrier is so designed that the flow carries it along thru the main and out at the far end. The carrier is now detached and the two ropes are secured together. The winch at the near end is operated and the small rope pulls the big one thru from the far end to the near end.

When the ⅛-inch cable is in place, the cleaning device is put into the hatch box, or the temporary pipe, with the cable attached. The hatch box or pipe is made up and the water turned on, but not at full pressure. The winch at the far end is started and the cleaning begins. Sometimes the carrier will stick. Its location may be determined by noting the amount of small rope withdrawn. An excavation will be made at this point and the difficulty dealt with.

The design of the carrier is quite interesting. In the patented device used there is first of all a cup or bell-shaped piece which fits into the main snugly, with its concave side opposed to the flow of the water. On the convex side the bell, made of rubber or other flexible material, is attached to a short cylindrical piece, which may be of wood. Stays of metal are attached to this piece and extend back to the bell, to which they are secured and supply it with resistance against a folding-forward movement. It will be understood that these stays are aranged at intervals in the circuit. Thru the piece of wood a wire passes, the rear end of which has an eye for the attachment of the steel rope. At the forward end of the device a cage in the form of a double pyramid is arranged. This contains within it a spherical shell of metal. This sheli acts as a float, supporting itself and the cage. This part of the device acts as a guide. Because of its tendency to keep to the top of the pipe, it facilitates passage over lumps of lead lying on the bottom and past downgoing branches of the pipe. This apparatus has been in practical service, where it has demonstrated its capabilities.

If the pressure of the water is considerable, the use of the cable may be dispensed with and the water relied on to energize the cleaning device. Suitable pressures and other favorable conditions are usually found in connection with the larger sizes of water mains, say from 6 inches diameter up. In one device, propulsion is secured by means of a pair of pistons arranged with cleaning devices ahead and to the rear. The pistons have adjustable passageways thru them. These permit the passage of a restricted amount of water on ahead. This is a very necessary part of the ar-

rangement, as otherwise the heavier cleaning would have to be done in the dry. The forward cleaners consist of a series of spiders carrying suitable knives or scrapers. These knives are set at right angles to the direction of the movement. To the rear of the pistons, two or three spiders are arranged with knives set at an angle to the axis of the pipe. By means of a kind of jointed or flexible shaft, the entire apparatus of cleaners and pistons is secured together, the whole having the appearance of a gigantic insect.

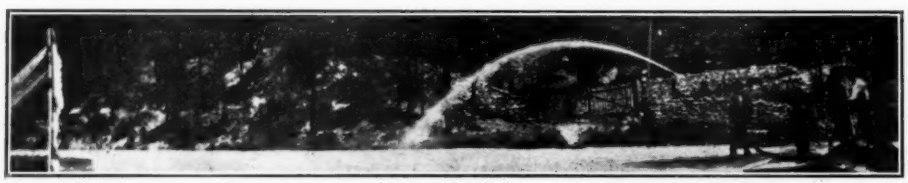
The cleaning is done by putting this affair, right end foremost, in the hatch box or the pipe arrangement at the near excavation and closing it up. When the water is turned on, the impulse against the pistons carries the device along. The knives cut and scrape, and are kept at their work by means of suitable springs or the like. The moderate amount of water passing thru the machine operates to carry off the debris from the walls of the main. In fact, an arrangement of blades diverts some or all of this water from the center outwards and thus puts it where it is mostly needed.

The adjustment of the orifices thru the pistons calls for practical experience. Once the machine starts, it cannot be recalled for better adjustment. Enough water must go thru to facilitate the cutting and to carry off the debris; enough must be left behind to drive the machine forward.

While the machine can not be recalled, still it may usually be located. There are three methods of doing this. First, the machine makes some noise. This is often sufficient to enable the ear to follow its forward movement. Second, the fire department hydrants will furnish by the character of the flow from them a means of approximating the position of the cleaning machine. Third, a small rope may be attached to the rear of the machine before starting it off. The length of this drawn in will serve to give the distance of the machine from the near excavation.

Another type of water-driven cleaner is sometimes used. This machine is a very effective piece of apparatus, being able to handle work that the other machine either can not do or can not do to advantage. This cleaner consists in part of a water driven turbine. The pressure of the water acting on a piston effects the drive. A certain amount of water, however, is permitted to pass thru the turbine, setting up a rotary movement of part of the apparatus. This circular motion is utilized to effect a scrap-

TWO PHOTOGRAPHS, *one taken before cleaning and one after, show the improvement in discharge from a hydrant on the water distribution system at Madison, Ind., by cleaning the mains.*



ing and cutting action across the direction of movement of the whole device. This rotary effect has proven very successful. Thus, at Salt Lake City, there was certain piping 16 inches in internal diameter which had an incrustation 2 inches thick. So difficult was the cleaning operation that the ordinary machine method proved scarcely adequate. In order to get results, the ordinary apparatus had to be taken thru repeatedly. The turbine machine was found quite competent for the work.

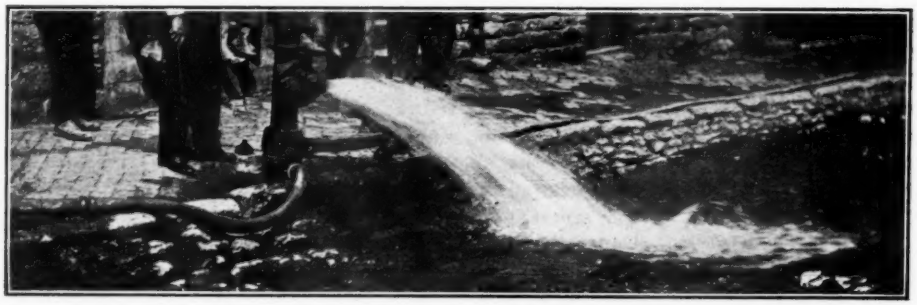
¶ PROVISION *for subsequent cleaning should be made during construction or in connection with the first cleaning of an existing system.*

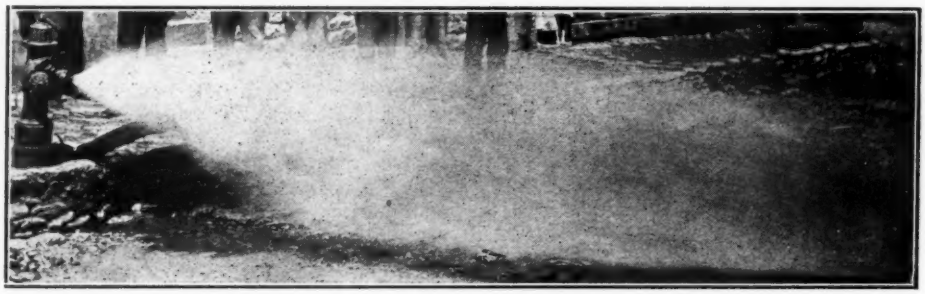
The cleaning of water mains by the foregoing methods has proved a very practical business. It is not a theory of what might be accomplished; but something which has been demonstrated by 500 or 600 miles of actual cleaning done under some form of contract. In the Boro of Brooklyn, New York City, alone, the amount of cleaning up to date totals in the neighborhood of 75 or 80 miles. In some communities the procedure has been carried out more than once.

In fact, the special hatch box used for the opening up of the main itself is a device which is used in contemplation of repetition work. The hatch box is put in as a permanent part of the line. This installation has been made in some cases a part of the cleaning operation. But in some others, the hatch boxes are introduced into the line at the time of original construction. This is notably the case at Troy, N. Y., where the 30-inch line is being equipped at intervals with this device. This special fitting consists essentially of a short length of pipe with the regulation nozzle and bell ends. There is, however, a portion of the body cut away. Here is provided a cover with bell ends. The cover is bolted in place and so may be accurately and quickly put in position. When the cover is in place, the whole forms simply a section in the pipe line. The internal diameter is, however, greater thruout most of its length than that of the pipe line. At the forward end the connecting taper is gradual. This taper is thus suited to the progressive compression of the cleaning device as it starts on its journey, and so facilitates the start off. At the rear end, there is, of course, a connecting taper, but it is fairly abrupt. The device is a patented one.

¶ COST OF CLEANING *in specific instances is given, with statement of conditions, that some idea may be gained of the probable cost in ordinary cases.*

The cost of cleaning varies with the local conditions. The principal concern engaged in the work supplies the foreman labor and the equipment. Perhaps as good an idea of the expense as can easily be acquired will be obtained by considering the case of Hartford, Conn., where a considerable amount of cleaning was recently carried out. This city is supplied by three mains, all cast iron. The diameters are 20 and 30 inches. All begin at a single reservoir several miles from the city hall. The ages at the time of cleaning varied from 16 to 37 years. The consumption of the city was steadily advancing, and it was realized that a new main would soon become inevitable. However, it was also seen that if a thoro cleaning of 9 miles of main would result in restoring the efficiency of the mains to a point which would make it possible to defer the installation of a new 36-inch pipe line for five years, not only money for the cleaning would be secured from the delay, but also money in excess. The minimum cost of the new line, 6¼ miles long, has been put at $270,000. In five years, interest compounded at 5 per cent. would amount to $74,500. An advance estimate of the cost of cleaning 3 miles of 30-inch pipe and 6 miles of 20-inch pipe put the cost at $15,300. Consequently, it was clearly to the advantage of the city to do the cleaning. But Hartford desired to be sure, before going ahead. So inquiries were made, amongst others, of Cincinnati, Rochester, Newton, Mass., St. Louis,





TWO PHOTOGRAPHS *show the increase in force of the flow from an open hydrant on a 4-inch main in Newport, Ky., made by cleaning the main.*

Brooklyn, Atlanta and the American Water Works & Guarantee Co. of Pittsburgh. All had had experience with large pipe. Apparently the replies were, on the whole, satisfactory, as a contract was entered into for a trial cleaning of 3 miles of 20-inch pipe. Ultimately, 6¼ miles of pipe were cleaned. The actual contract price for the first 3 miles, as stated by the Chief Engineer of the Board of Water Commissioners, was 28 cents per linear foot, the contractor furnishing all labor concerned in the cleaning operations. There was to be a reduction if a greater length was cleaned. Ordinarily, at Hartford, there was a force composed as follows: 1 superintendent, 1 foreman, 1 calker, 14 ordinary laborers and a 2-horse team. The minimum pressure available was something in excess of 10 or 12 pounds per square inch. These pressures are ordinarily sufficient to drive the spider type of machine, the one employed for the work. There were three spiders in the forward section. These had cutters with saw teeth. Then came two spiders with smooth scrapers. Following these were two pistons. Behind them, bringing up the rear, were two rings of scrapers set askew. These scrapers were, in the one case, set in agreement with a right hand thread; and, in the other, with a left hand thread. In the whole machine, there were thus 7 separate circlets of scraping tools. The main cutting is done ahead of the pistons.

The cleaning at Hartford was suspended after cleaning 6¼ miles because of the scarcity of water in the reservoirs. Five miles belonged to the 37-year-old 20-inch pipe and 1¼ miles to the other 20-inch main, which was 25 years old or more. Careful tests of capacity were made in both cases both before and after cleaning. After cleaning, the capacity in both cases was found to approximate that for new pipe. Further, the increase in capacity in the older line was found to be 69 per cent. In the case of the younger main, the increase was 50 per cent.

The consumption of water in the cleaning process was experimentally ascertained to be about 3 times the quiescent capacity of the portion of pipe cleaned. Altogether, it is estimated that the 6¼

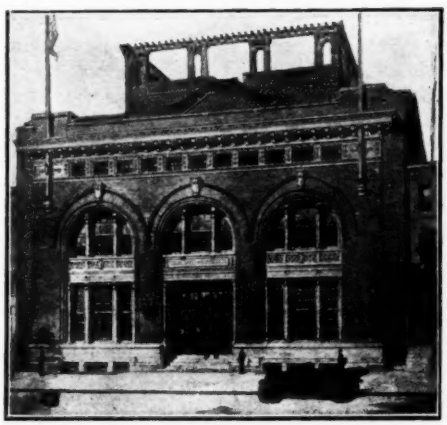
miles of 20-inch main required 1,655,000 gallons.

The material which clogs a pipe may be iron oxide or it may be a calcareous deposit, or something still different. The thick deposit mentioned as occurring at Salt Lake City seems to have been a carbonate of lime. In color, the material may be almost white; then it will be a red or a gray or a still darker hue. It is composed at times almost entirely of ingredients furnished by the water alone. At other times, the pipe itself will contribute a considerable percentage. Sometimes the obstruction in a pipe will consist largely of sediment made up of mud, rock particles and dead organisms. Such obstruction is usually fairly soft and presents but little difficulty in cleaning.

It will readily be granted that where the effective cross-section is cut down, so also will the capacity of the pipe. However, the flow of water is nearly always impeded to a considerable extent by small incrustations which scarcely affect the cross-section. Incrustations in the form of small and separated nodules will seriously affect the velocity. They may be not over 1-16 or ⅛ of an inch in height. Such nodular incrustations were sufficient in the case of a 48-inch main to reduce its capacity 30 per cent. This loss must be attributed almost entirely to friction; the nodules must have reduced the cross-section only by an inappreciable degree. That such excessive reduction of capacity may result from simple roughness of surface is confirmed by experience with coated pipes. It is said that a variation of as much as 25 per cent. may arise from the greater or less degree of smoothness of the coat put on. It is clear then that we have in the mere roughing of the surface a serious cause of reduced efficiency.

It will be understood then that a cleaning operation may be indicated as the proper step even where the cross-section remains approximately the same. The way to get convincing testimony is to compare a test of efficiency when pipes were new with another test made at a time when substantial loss of efficiency is suspected. Or, comparison of present flow with the flow that should be attained is another method of testing the matter. This is not as satisfactory a procedure as the comparison of two actual performances, inasmuch as the calculation of what should be turns on formulae, in using which it is difficult to take into account the special local conditions. In comparing two actual performances, nearly all the important factors except the incrusted interior are precisely the same for both. This results in reliable information.

PUBLIC BATH AND GYMNASIUM



The most extensive public bath and gymnasium yet designed for New York is located opposite Chelsea park. William Emerson is architect of this handsome and convenient building, photograph of the drawing for the front of which is shown herewith. It provides public laundry in the basement, boilers and machinery for heating, lighting and ventilating the building and supplying water for shower baths and pool, swimming baths and gallery in first and second floors with shower and tub baths on the remainder of both floors; gymnasium in the third and fourth floors with running track around at the level of the fourth floor, and outdoor play space over the entrance lobbies and stairways, on the level of the fourth floor and over the rest of the building on the fifth floor. It cost about $165,000.

Street Lighting Fixtures

The modern high-candle-power incandescent electric lamps have made necessary entirely new designs for fixtures for street-lighting service. Some of these new forms are illustrated and described in this article, which will give data for comparison with other modern systems by those contemplating improvements in their present street lighting.

THE introduction of high candle-power Mazda lamps and the new conditions under which they operate required the design of an entire new line of fixtures to accommodate them properly. The several specific reasons that have induced the development of these distinctly different types of fixtures are the following:

1. The intense brilliancy of the lamp requires that the light source be screened in order to obviate all of the disadvantages from glare.

2. The lamp in operation is designed to reach a very high temperature, and it is essential that the fixture be so ventilated that it is maintained at a temperature which will do it no injury.

3. The lamp must be protected from moisture and atmospheric changes.

4. The shape and size of the bulb being different from that of previous standards of the vacuum lamp, it was necessary to make a fixture that would bring the light center to the correct location.

5. Due to the fact that high-current series lamps operate at a very much greater efficiency, it is very desirable to provide an individual compensator in each lamp that will increase the current in the lamp from 6.6 or 7.5 amp. to 15 or 20 amp., as the 400 c-p. lamps operate at 15 amp. and the 600 and 1,000 c-p. lamps at 20 amp.

To provide for these contingencies, complete lines of street lighting fixtures have been designed that fulfill every requirement. In general, these fixtures may be divided into three different classes, namely, bracket type, pendant type and ornamental type.

The bracket and center-span suspension fixtures, which are almost universally known, have been re-designed to accommodate the following reflecting equipment: Radial wave reflector, concentric reflector or concentric reflector with prismatic refractor.

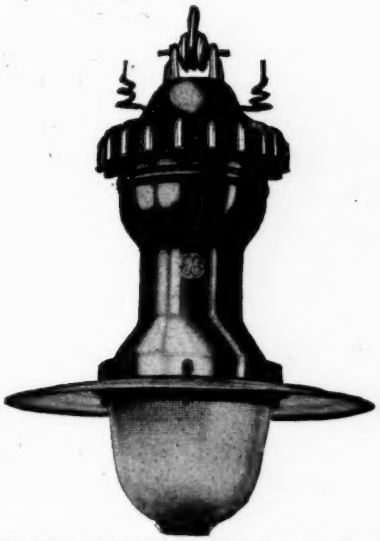
The pendant units have been designed in two different classes, known as Form 1 and Form 2. The Form 1 unit has been designed to resemble the arc lamp in general contour and appearance. It has a very substantial construction thruout. These units can be furnished with an opal diffusing globe, an opal diffusing globe and concentric reflector, a prismatic refractor and clear globe, or a prismatic refractor.

The Form 2 pendant units are unique in appearance and cost less than the Form 1. They are arranged to use a diffusing globe, concentric reflector and diffusing globe, radial wave reflector, or a concentric reflector and prismatic refractor. Both the Form 1 and Form 2 units are arranged to take a compensator, which is mounted under the dome and inside of the casing.

The ornamental Novalux Unit has been designed to fill the demand for a highly ornamental unit where "White Way" lighting is desired; and two different styles of ornamental units, known as the Forms 4 and 5, have been standardized.

NOVALUX *ornamental street lighting unit with upright lamp.*

PENDANT *Novalux street lamp resembling an arc lamp in appearance.*



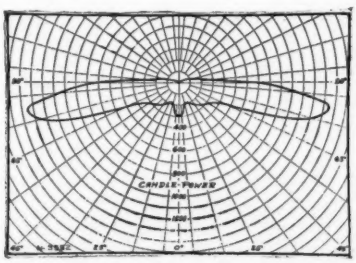
DISTINCTIVE *original design for Novalux street lamp, which is also cheaper.*

Light distribution from a bare incandescent lamp is not suitable for street illumination. By using the various forms of fixtures equipped with reflectors and outer globes, this distribution, altho at a decrease in specific consumption, is improved to such an extent that the illumination is more economical. It was not, however, until the introduction of the prismatic refractor that the distribution from incandescent units could be so directed as to produce a decided maximum at an angle approximately 10 degrees below the horizontal. With such a distribution, it is now possible to increase the spacing of these lighting units without destroying the even illuminating effect that heretofore could only be accomplished with incandescent lamps by using a number of comparatively low candlepower units.

The accompanying distribution curve gives a graphic idea of the improvement given by the prismatic refractor. The refractor used in these lamps consists of two sections one fitting inside the other. The inner section is girdled by a succession of horizontal prisms, which converge the light rays into the most useful zone; while the outer globe is lined with a series of vertical prisms, which serve to diffuse the light. The inner surface of the interior section and the outer surface of the exterior section are smooth; therefore, both sections when placed together and the top cemented present smooth outside surfaces, which facilitate cleaning, as they do not readily gather dirt and dust.

All fixtures described are suitable for all standard commercial circuits, both series and multiple.

CHARACTERISTIC DISTRIBUTION CURVE *of 600-c.p. Mazda series lamp unit with concentric reflector and prismatic refractor.*



BRICK ROADS AND STREETS

By John Laylin, Division Engineer,
Ohio State Highway Department, Columbus, Ohio.

The author of this paper gives his experience in municipal and state highway improvement work in which brick has been used as the paving material, and the methods in use by the Ohio State Highway Department, at the request of the management of the Road Congress held in Chicago with the American Road Builders' Association. It is therefore an official statement of the methods and results in a state which has used more brick in both city streets and country roads than any other.

THIS paper will treat this subject largely from the writer's experience in municipal and state highway improvement work.

Ohio statutes provide for state aid in road building on a system of inter-county highways, so-called, lying wholly without the limits of municipalities, comprising a network of roads aggregating about 9,500 miles, and connecting all county seats and towns of any considerable size within the state.

The law is very flexible in regard to the distribution of costs of improvements and was designed to meet all possible conditions, but in a general way it may be stated as 50 per cent. to the state, 25 per cent. to the county, 15 per cent. to the township and 10 per cent. to abutting property. County commissioners designate the particular section of the particular inter-county highway that shall be improved in any year and guarantee the payment of costs to be levied against the county, township and property owners, and further determine the particular type of improvement to be made.

Inasmuch as the county commissioners are a party to every contract made and entered into, it may be readily understood that the highway commissioner does not select the particular type of pavement to be constructed, even if inclined to do so. Types of pavements are generally selected, however, that best suit traffic conditions and utilize suitable materials near at hand.

The highway commissioner has ever tried to treat all material and supply men with the utmost fairness, and his splendid success in the management of the department and the construction of a great highway system is largely due to the hearty co-operation of all classes of material and supply men.

After a type of pavement has been selected for a section of road to be improved, then the commissioner does insist that the construction of the work shall be of the best for that particular kind of pavement.

The essentials of a good road or street are good alinement, easy grades and perfect drainage.

Resident engineers working under the directions of department division engineers make the field surveys, plat the alinement, profiles and cross-sections, and work out all questions of new locations, grades, cross-sections, sewers and drains, bridges and culverts, and plans are made to show type and dimensions of foundation, thickness of sand cushion, kind and dimensions of curbing, kind and thickness of expansion joints, all details of drainage, bridges and culverts, and

everything not fully set forth in the general specifications of materials and workmanship.

In passing, it might be said that efforts are always made to secure a clear sight view of at least 300 feet, a maximum gradient of 8¾ per cent. and a drainage system that will maintain a water level well below the base of foundation of pavement.

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¶ THE OHIO STATE *Highway Department specifications have been carefully prepared and produce excellent pavements.*

The 1914 specifications for brick pavement improvements provide as follows:

In the preparation of the sub-grade, all muck, quicksand, soft clay and spongy materials that will not consolidate under the steam roller shall be removed, that back filling of all excavations shall be rammed in courses of not more than 6 inches of loosely filled earth, that embankments shall be built up from the bottom in successive, even layers not exceeding 12 inches in thickness, that each of these layers shall be rolled until thoroly compacted, that when the slope exceeds 2 to 1, such slope shall be furrowed before any material is placed thereon, and that areas on which embankments less than 1 foot in depth are to be placed shall be broken up by plowing or other means.

After the surface of the sub-grade has been properly shaped, the road-bed shall be thoroly rolled and compacted so that it does not wave or spring under the roller. Rolling shall be done with a self-propelled roller weighing not less than 6 tons.

Foundation for pavement may be of either portland cement concrete, old pavement, compacted broken sandstone, limestone, slag, gravel or vitrified clay.

Great care is to be used in selecting aggregates for concrete, all materials being submitted to tests to insure quality meeting requirements as specified in Bulletin No. 25, General Specifications for Materials.

Aggregates are so proportioned as will produce concrete substantially composed of 1 part cement, 2½ parts fine and 5 parts coarse aggregates, in which the mortar shall not be less than 110 per cent. of the volume of the voids in the coarse aggregates.

Coarse aggregates may consist of crushed boulders, crushed limestone, slag or gravel that will pass a screen having openings 1½ inches in diameter and be retained upon a screen having openings ¼ inch in diameter.

A cubic yard of concrete in place shall not contain less than five sacks of cement.

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¶ THE MIXING *and placing of materials and treatment of completed pavement before letting traffic on it are most important details in securing a good pavement.*

Concrete shall be mixed in a batch mixer, so-called, the drum of which shall not make less than 15 revolutions at a speed of between 15 and 20 revolutions per minute.

Materials shall be mixed sufficently wet to produce a concrete that will require no tamping. Sub-grade must be moist before concrete is placed thereon.

The surface of concrete shall be shaped by the use of a suitable template cut to conform to the crown of pavement, and shall be floated in such a manner as to thoroly compact the concrete and produce a surface the exact crown specified. The finished surface of the concrete shall conform so nearly to that indicated on the plans that it will nowhere vary more than one-half inch from the previously described templet or a 10-foot straightedge applied to the surface of the concrete and parallel with the center line of the pavement.

Care shall be taken to protect concrete from rapid drying out and freezing, and traffic is prohibited for ten days from time of laying.

A thoroly consolidated old macadam or gravel road, if of sufficient depth, may be considered satisfactory pavement foundation. The old road shall be thoroly cleaned, and, if irregular, shall be scarified, graded to the proper elevation

and all depressions filled with the same material of which the course consists. All foundation material placed must be thoroly filled, waterbound and compacted.

Rolled foundation shall consist of either gravel, broken sandstone, limestone, slag or vitrified clay. Sandstone fragments must not exceed 6 inches in greatest dimension, and all other materials must pass a screen having 4-inch circular openings and be reasonably well graded from 4 inches down to the smallest size found in the product.

Gravel shall not contain more than 15 per cent. of clay or loam.

Rolled foundation shall be constructed as a one-course waterbound macadam pavement and brought to the proper crown and grade within the limits specified for concrete foundation.

Curbing shall be either sandstone or concrete of dimensions indicated on plans and quality as specified in said Bulletin No. 25.

Sand cushion shall not contain more than 8 per cent. by weight of clay or loam. Sand shall be spread over foundation, shaped with templet, rolled till compact, and made ready to receive the paving blocks.

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¶ LAYING OF BLOCKS *and pouring of cement grout filler must be carefully and properly done or the result will be disappointing.*

Paving blocks shall be laid in an upright position upon the sand cushion, in straight courses across the road, and shall be laid so that the longitudinal joints are broken approximately at the center of each block and the long dimension of the block is perpendicular to the center line of the road on the tangents and practically parallel with the radius of curves having a radius not greater than 150 feet.

All blocks to be laid with the lugs in the same direction and set as closely together as possible. In all cases the end joints shall be made close and tight, the joints to be at right angles to top and sides. The cutting and trimming of blocks shall be done by experienced men and proper care shall be taken not to fracture or injure the part to be used.

After a sufficient number of blocks shall have been laid the pavement shall be thoroly dampened by sprinkling, and all soft, porous or unacceptable bricks will be marked by the inspector and shall be removed by the contractor. When any section shall have contained more than 10 per cent. of rejections, the blocks of the entire section shall be taken up and the cushion readjusted. As soon as possible after the blocks in the pavement are inspected, rejections removed and replaced with acceptable blocks, the surface shall be swept clean and then rolled with a self-propelled roller weighing not less than 6 tons. When rolling and ramming are completed, the surface of pavement shall conform so closely to that indicated on the plans that it will nowhere depart more than ⅜ inch from a properly formed templet or a 10-foot straight edge applied to its surface.

Soon after the pavement has been compacted and surfaced, the joints between the blocks and the curb shall be filled with a grout filler composed of one part portland cement and one part sand. Detailed specifications set forth manner of applying grout.

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¶ SPECIFICATIONS *for paving brick are standard and have demonstrated the value of years of careful work in devising and improving them.*

Paving brick specifications provide:

That the brick shall be standard wire-cut-lug or repressed paving block of standard size. The standard size of brick shall be 3½ inches in width, 4 inches in depth and 8½ inches in length. The brick shall not vary from these dimensions more than ⅛ inch in width and depth and not more than ½ inch in length, and the brick of the same shipment shall not vary more than ⅛ inch in width or depth. They must be thoroly vitrified and annealed, regular in size and shape and uniformly burned. When broken, they shall show a dense, stone-like body, free from lime, air-pockets,

cracks and marked laminations. No surface of any brick shall have kiln marks more than 3/16 inch in depth or cracks more than ⅜ inch in depth and the wearing surface of the brick shall not have kiln marks more than 1/16 inch in depth and shall be free from cracks. The brick shall have not less than four nor more than six lugs, all on one side of the brick, such that when the brick are properly laid in place in the pavement, the joints between the brick will be not less than ⅛ nor more than ¼ inch in width. The name or trade mark of the manufacturer, if shown on such brick, must be by a recessed design or by recessed letters and not by a raised design or raised letters.

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¶ METHODS *of selecting brick for abrasion test and methods of making the test are those proposed to the American Society for Testing Materials, which are still under discussion and observation as to their sufficiency.*

If the edges of the brick are rounded, the radius shall not exceed ⅛ inch. The brick must not be chipped in such a manner that neither wearing surface remains intact or that the lower or bearing surface is reduced in area by more than .1, but such brick, if otherwise satisfactory, may be used in obtaining the necessary half brick for breaking courses and the necessary pieces of brick for closures provided that the wearing surfaces of the part of brick used shall be intact. The brick shall not be glazed. To determine whether the material of the brick as a whole possesses to a sufficient degree strength, toughness and hardness, samples of the brick shall be submitted to the rattler test. The test shall be made in accordance with the method and in a rattler as described in the recommendations by the sub-committee on paving brick to the American Society for Testing Materials. Five samples of each kiln or shipment may be selected; one sample from what appears to be the softest brick and one sample from what appears to be the hardest brick, neither of which shall lose of their weight more than 24 per cent.; and three samples representing an average of the kiln or shipment, which shall lose of their weight not more than 22 per cent.

The quality of the brick shall be of such uniformity that the range between the highest and lowest loss by abrasion shall not exceed 8 per cent. If the kiln or shipment of brick should fail to meet the above requirements, and it is fair to assume that it would meet them if not more than 10 per cent. are culled, then the contractor may, at his option, regrade the brick. When the regrading is complete, the kiln or shipment then shall be resampled and retested, as under the original conditions, and if it fails to meet any of the above requirements, it shall be finally and definitely rejected. Sampling may be done at the factory prior to shipment and brick accepted as the result of such sampling will not be rejected as a whole, but will be subject to such culling as may be necessary to meet all of the requirements except that of the rattler test.

The Ohio State Highway Commissioner let contracts for brick roads in 1912, 1913 and 1914, mileage as shown in the following table:

	1912.	1913.	1914.
Mileage brick roads contracted.....	33.47	27.71	164.0
Per cent. brick road of total mileage of all roads	20.7	17.7	32.5
Contract price for brick roads.....	$507,899.19	$486,925.87	$3,415,584.45
Per cent of total contract price of all hard surfaced roads.....	36.4	35.3	46.3
Average contract price per mile for brick roads	$15,680.00	$17,572.00	$20,827.00
Average contract price for brick roads per foot in width per mile.....	$1,150.00	$1,379.00	1,364.00

The contract price for brick roads included grading, draining, curbing and paving for the years 1912 and 1913, but also included bridges and culverts for the year 1914.

In the preparation of our plans it is our endeavor to embody the use and requirement of the best possible foundation, and the best possible drainage consistent with the economy of the road.

Following this rule, a concrete foundation for brick pavements is generally provided, and as the greatest assurance against longitudinal cracking in the wearing surface, the advantage of a dry subbase is considered essential. It is the general belief that brick pavement cracks are caused more by frost action than high temperature stresses. In fact, a sufficient and proper drainage of the sub-grade of all roads, including the brick road, is regarded as of the utmost importance. Frost has little effect where moisture is almost entirely absent; hence these provisions carefully observed are certain to reduce to a minimum all deleterious climatic effects.

There are a few examples of brick pavement construction that the writer especially desires to call to attention.

¶ SPECIAL DESIGNS *for brick pavements are cited and success in use and beauty of appearance are indicated.*

The Cleveland-Buffalo I. C. H. No. 2, in Lake County, is a 2½-mile improvement with brick surface 18 feet in width, curbed on either side with a 24-inch concrete gutter having a 2½-inch concave surface. These gutters collect the water that falls on pavement and lawns and conduct it to catch basins connected with a system of underground drains. The pavement is laid on a 4½-inch concrete foundation. The lawns slope back from the gutters and the parklike effect is very pleasing.

Many of the brick pavements in northern Ohio on streets and roads having a sandy or gravelly soil are laid on natural bed foundations, and where traffic is light or medium such streets are giving first-class service. Many such streets have been in use 20 years and more, and they give every evidence of being good construction.

Two streets in Norwalk, Ohio, have been laid on natural bed foundations and edged with vitrified curbs. These curbs were made on a regular paving brick machine with three out of four of the cutting wires removed, thus making a block that when burned was 4 by 8½ by 15½ inches. These blocks were set with the 8½-inch dimension vertical and set in gravel or crushed limestone.

The pavement when grouted with a 1-to-2 cement mortar practically became monolithic. This work has been in place less than two years, but it looks like good, cheap pavement construction. The writer has watched for a number of years two streets in a small village that were curbed with ordinary paving block stood on end and thoroly grouted. The earth next to such blocks has worn away in places and the edges of the bricks have become rounded, but they are still doing business and holding pavement intact.

A number of Ohio roads have been designed and constructed with concrete foundation and curb constructed monolithic, and such construction is to be recommended.

¶ ROADS ABOUT CLEVELAND, *constructed without State aid, are briefly described and the improvements in design and construction are noted.*

Cuyahoga County, Ohio, is noted for its brick country roads, there being over 350 miles outside of the City of Cleveland.

These roads have generally been constructed 14 feet in width, located on side of roadway, the balance of roadway being graded to width of 7 feet or more and used as an earth drive.

The earlier roads built were constructed with rolled foundations and not very much attention was paid to matter of drainage, but brick roads as now constructed are well drained and provided with concrete foundations. Concrete and sandstone curbing is employed, and in

all cases the pavement slopes so the surface drainage flows away from the earth track. Raised curb is often used on the outside, and on hills raised curbs are used on both sides of pavement, drainage being provided by catch basins and underground drains.

On hills, hillside block and Medina block are used.

Traffic is very heavy in and about Cuyahoga County, and the brick roads seem to have solved the road problem.

In conclusion, it may be said:

That brick roads and streets should always have a solid sub-grade, perfectly drained.

That a concrete foundation should be provided wherever traffic conditions are heavy, and that the surface of concrete foundation should be made true and smooth and exactly parallel with the crown of street.

That the sand cushion should be thoroly compact and from 1½ to 2 inches in thickness.

That a cement grout filler is the best filler.

That a brick road is a dependable road.

The paramount interest in brick roads that more greatly concerns the tax-paying public is the same that is involved in the expenditure for any road, no matter what the type, and that is the efficient building of the road itself, the compliance with the plans and specifications. The proper construction of a brick road is no more difficult than the construction of any kind of road, but every requirement of the plans and specifications should be carried out. Plans, specifications and contract presuppose that each and every requirement therein is a part and parcel of a necessary adjunct to the value of the road intended to be built. A complete co-operation of the combined influences of public sentiment, official authority and the obligation of the contractor are necessary to reach the ideal in road building. Without the combined forces of all, the most conscientious official, the most diligent contractor or an anxious public acting singly and alone can not attain the best results.

Transcontinental Automobile Routes

Late reports indicate that the road improvements on the principal cross-country lines during 1914 have been underestimated rather than overestimated. This is particularly the case on the western end of the "Northwest Trail," between Montana and Seattle, especially since the former severe grade of Snoqualmie Pass has been reduced to a maximum of 5 per cent.

Hundreds of miles of the Lincoln Highway have been improved and marked. In Ohio over three-fourths of the entire length of the route has been hard-surfaced with cement, brick or other material. In Indiana the bond issues passed by the local communities aggregate over three hundred and fifty thousand dollars. On September 16, Elkhart, Ind., opened a section of concrete Lincoln Highway 18 feet wide; work is now in progress on a 6-mile section near Fort Wayne; St. Joseph county, in which South Bend is located, has voted $175,000 for immediate improvement. Governor Dunne, of Illinois, personally began work on the Lincoln Highway in his state on April 16, by turning over the first spadeful of earth at Mooseheart, and on the 16th of June, this section was opened with appropriate ceremonies as a part of the Lincoln Highway. Five counties in Iowa have voted a total of $140,000 for Lincoln Highway improvement.

Both the "Trail to Sunset," and its principal alternate, the Santa Fe-Grand Canyon-Needles Highway, have not lagged behind the others, and, beginning next year, the tourist has two complete options between Albuquerque and southern California, both of which can be traveled with comfort and safety. The National Old Trails road has been marked from the Pacific coast to Kansas City and in sections farther east.

While, unfortunately, some parts of the "All-Southern Route" are yet in poor shape, that line as a whole has been greatly improved during 1914, and will not present very serious difficulties to tourists who decide to go leisurely across that way in 1915. The A. A. A. Touring Board has the latest information on all these lines, and is prepared to confer with tourists on the routes best suited for their particular purpose.

CONCRETE CURB AND GUTTER

AS CONSTRUCTED IN DENVER, COLO.

By E. B. Van de Greyn, Consulting Engineer.

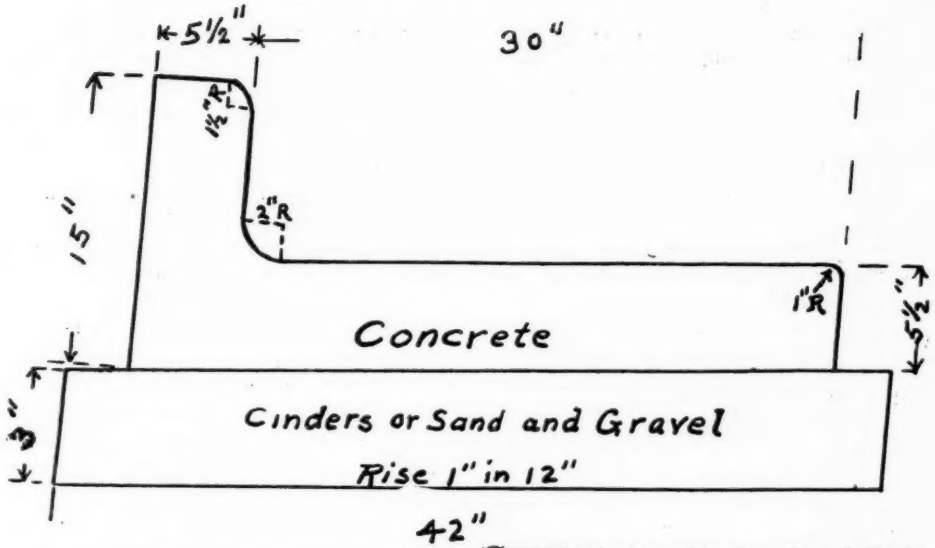
Some years ago the city of Denver, Col., introduced a method of constructing concrete curb and gutter without separate mortar facing and mortar top, which has been successful. The author of this article describes the process from his personal experience with its use in Denver and in other localities.

THE form of combined concrete curb and gutter generally constructed consists of a concrete body and a mortar coat on the exposed faces. The mortar face on the curb is secured by plastering the form board ahead of the concrete work, or it is secured by using a templet just behind the face board and after the concrete is in place and stiff enough to stand up the templet is removed and the space between the concrete and face board filled with mortar. In many instances in such work it is observed that the mortar facing checks badly and in some extreme cases the mortar falls from the body of the curb.

In the city of Denver for some time past the mortar facing and top has been dispensed with in combined concrete curb and gutter work, and the finish made directly on the concrete by proper spading and trowelling. This resulted in lessening the cost to the property owner an amount worth saving, and also resulted in work that does not show check marks. The appearance of the curb and gutter has been satisfactory enough so that there are no complaints from property owners on that score. There are, of course, the complaints that come when a contractor has a piece of work spoiled by bad workmanship or material or because of putting in concrete in freezing weather. Several hundred thousand linear feet of such solid curb and gutter have been constructed in Denver in recent years, the first of such work being started under Hon. John B. Hunter, then chief engineer of the city and county of Denver and now commissioner of public improvements. The fact that such a large amount of the curb and gutter has been constructed in the past and that more is being constructed is evidence that it has proven satisfactory to the property holders.

The proportion of the concrete used in such work should be such as to allow of an ample surplus of mortar over what is needed to fill voids in the gravel or broken stone. This excess is needed in getting a good finish on the exposed face of finished work. The proportions commonly used in Denver were 1:3:3. Recently a 1:2½:3½ mix has been adopted with good results. A finish can be secured with 1:2:4 mixture but it is not recommended because such a mixture requires more work to secure a finish and there is danger with careless workmen of not being able to get a good finish in spots. Assuming voids in stone at about 40 per cent., 1:3:3 mixture gives an excess of mortar over that required to fill voids of about 150 per cent.; in the 1:2½:3½ mixture the excess is about 80 per cent. The writer had contractors on several jobs try out various mixtures and finds those mentioned give excellent results.

The method of finishing the concrete



SECTION *of combined curb and thirty-inch gutter. An expansion joint three-sixteenths inch wide is located every six feet.*

is as follows: The concrete is mixed quite wet, i. e., to a mushy consistency, and is shoveled and tamped if needed. One man immediately strikes off the surface of gutter with a straight edge resting on the steel templets which cut the curb and gutter every six feet. This straight edge is worked back and forth forcing the stones down and leaving the mortar on top. Following this a second man works the top of the concrete with a wood float. If a smooth finish were desired in the gutter a steel float could be used. The working of concrete with trowels brings the mortar to the surface.

On the curb work the concrete is spaded thoroly along the face board and the top of curb is struck off with a straight edge in a manner similar to gutter. Following this after concrete has dried a little a man finishes top of curb with steel trowel and runs an edger over top corner of curb. As soon as concrete has set sufficiently to allow it the face board is removed from curb and the steel templets are pulled. Then the finishers run a steel edger along outside edge of gutter and on both sides of expansion joint in gutter. This gives a panel effect to each 6-foot section of gutter. Two steel trowels are used on the curb; one trowel is curved to fit top of curb and come down about half way on face of curb; the other trowel reaches halfway or more up the curb face and about 4 inches onto gutter. These trowels are bent to give the radii required at top corner of curb and juncture of curb and gutter. Occasionally a spot is found where the rock shows and this is doctored by trowelling in a little mortar. As soon as practicable after curb is finished the curb and gutter are covered and kept moist.

To illustrate the organization used on this work and what can be done the following is given for one day's work by one of the best equipped contractors. The writer was furnished the following data by The Gaffey and Keefe Construction Co. of Denver. The dimensions of curb and gutter are shown in sketch submitted herewith. Material costs were as follows:

Cement, delivered on work....$1.75 bbl.
Sand, at pit.....$0.33 cu. yd.
(One team hauled 8 cu. yds. in 8 hr. day.)
Gravel, at pit ..... .66 cu. yd.
(One team hauled 8 cu. yds. in 8 hr. day.)
Cinders, delivered, about.... .60 cu. yd.

(It might be noted here that the standard plans of the city call for cinder bed 6 inches deep, but 3 inches was used on this job.)

Equipment used on job, not including wagons for hauling concrete material, was:

1 ¾-cubic yard cube mixer.
6 1-horse concrete carts each 2/3 cubic yard capacity.
2 water wagons.
1 wagon for moving forms.
Other small tools such as shovels, barrows, concrete pan, etc.

The organization and hours of labor were as follows:

2 foremen, 8 hours each.
1 timekeeper.
1 night watchman.
2 water boys, 8 hours each.
6 1-horse carts and boy driver, 8 hours each.
1 team and driver on wagon moving forms, 8 hours each.
2 teams and drivers on water wagons, one wagon used for wetting down cinders and other wagon for keeping finished curb wet, 8 hours each.
Form setters, 27 man hours.
Helpers, 52 man hours.
Cinder men, 67 man hours.
1 gutter tamper, tamping base under cinders, 8 hours.
2 tampers, tamping cinders and concrete, 8 hours each.
Men shoveling concrete from pan into curb and gutter, 40 man hours.
1 finisher, 8 hours.
Helpers to finisher, 40 man hours.
Men wheeling gravel and sand to mixer, 48 man hours.
Man and helper feeding cement to mixer, 16 man hours.
1 engineer, 8 hours.
Labor on ditch for curb, 192 man hours.

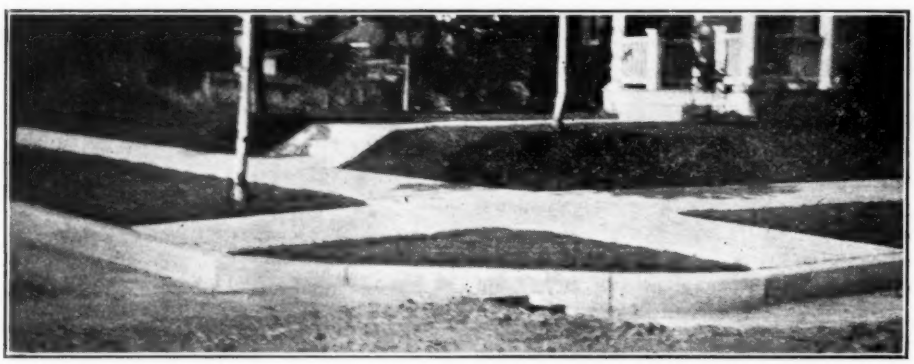
The above gang put in about 2,000 linear feet of the combined curb and gutter shown in the sketch. There is about 1.70 cubic feet of concrete per linear foot of curb, hence the 2,000 linear feet equals 126 cubic yards.

There were 88,000 linear feet of the curb and gutter in the contract and the contract price was 49 cents per linear foot. Excavation of trenches is paid for separately by the city on cubic yard basis as a part of the job if grading the street between property lines. The work of grading the street and of building curb and gutter and cross walls is all let in one contract.

Engineers reading this are cautioned about basing estimates on the price of 49 cents because the contract was taken at a time when work was slack and contractors hungry for work even at low prices to keep their men employed and their horses and equipment busy. It takes a trained organization experienced in the work to put in such a large amount as 2,000 linear feet of curb and gutter in 8 hours. The prices generally bid on this work range from 50 to 60 cents depending on length of haul of materials, labor conditions, and whether contractors are busy or not. The well equipped contractors average 1,400 to 2,000 linear feet per day of the curb and gutter work.

The view shows the good appearance of curb and gutter built as outlined above, i. e., without the regulation mortar facing.

APPEARANCE *of one-course curb and gutter on Denver street corner.*



TRAFFIC CONGESTION PROBLEM

IN BROOKLYN, N. Y.

By W. H. Messenger, Assistant Engineer in Charge.

The many complaints of congestion of traffic in the Brooklyn, New York, streets, between Boro hall and the Brooklyn bridge, and of noise about the court house, caused a survey to be made of the conditions existing, of which survey the author was in charge. A method of relief by re-routing street cars, which were found to be the main cause of delays in passage of traffic, was proposed. The paper from which this article is taken was presented before the Brooklyn Engineers' Club and contains the details of the re-routing plan. This article sets out the principles of procedure and enough of the detail of the special case is retained to indicate how these principles may be applied in any particular case.

THE rather serious congestion and delay to all surface traffic in the downtown business section of the Boro of Brooklyn, caused by a combination of factors which the writer will attempt to set forth and analyze, has been forced on the attention of the public for some time past. The city planning committee has had the question under investigation for over two years, and the results of its inquiries have been publicly shown by a series of plans, which for their execution would call for very large expenditures both now and in the future.

The Boro president of Brooklyn has, of course, been very deeply interested in this question, and has given the problem to the chief engineer of the Bureau of Highways, Mr. H. H. Schmidt, who has made reports accompanied by plans, diagrams and statistics. The collection of the traffic statistics, together with the preparation of the plans and diagrams, having been given to the writer to do, he will try here to show the methods used, the data obtained as well as some of the measures of relief proposed.

The methods used were taken from those of the general traffic census of the Boro, and in order to best bring out these methods, a description of that census is given. The traffic census of the Boro was organized some three years ago for the purpose of finding the traffic density and tonnage thruout the Boro, as a guide in the design of pavements and for various other purposes. The locations at which observations were made during the year 1913, took in, as far as possible all the important and typical paved streets of the Boro. The work goes on thruout the year, with the exception of the months of January, February and March, when the weather conditions are generally such as to make the results that might then be obtained of very little value.

The records are taken by a corps of observers composed of one foreman and from 6 to 12 laborers, working rain or shine every day, Sundays and holidays only being excepted. The working hours are 8, from 8 a. m. to noon and from 1 to 5 p. m. Usually three records are taken at each location, with 15 day intervals between, so as to vary the day of the week. With the force available, from

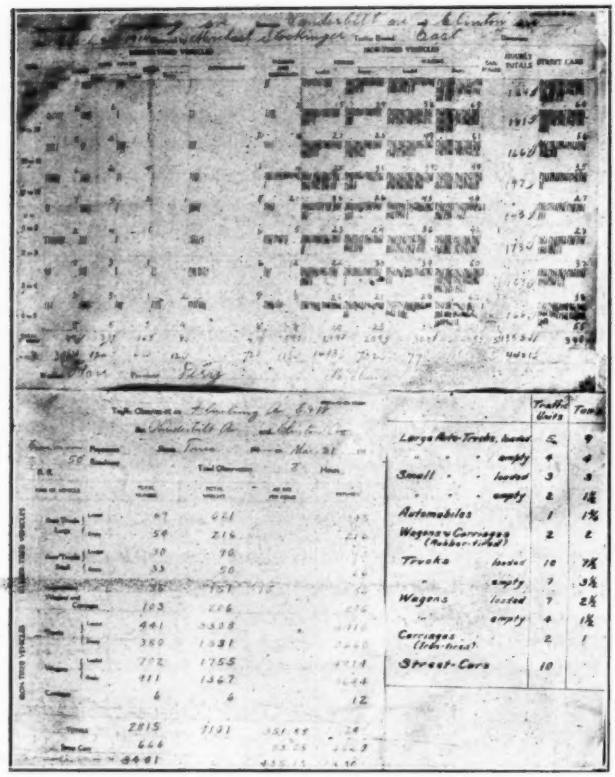


FIGURE I. *Enumeration of traffic units and tonnage for each class of vehicle enumerated, being a sample of an ordinary day's observation card and report summary.*

600 to 800 different locations are observed each year. The points of observation are so planned that a fairly accurate estimate can be made of the traffic density and tonnage in any given street or district. Where it is impossible to estimate by interpolation the data for a given street, special observations are made as required. While the largest part of all records are of 8 hours, some 16 and 24-hour continuous records are taken at different times and places, so that a fair ratio between the day traffic and that for the full 24 hours is obtained, this last item being used principally to obtain the tonnage per annum.

As the density of traffic is dependent on the size, speed and flexibility of the vehicles passing any given point, any analysis that will give an adequate measure of these quantities is of the first importance. Such a measure has been found and used in its work by the traffic branch of the London County Council. This measure is in the form of a factor or co-efficient, having a relation to the size, speed and flexibility of the vehicle, and is called a traffic unit. Applying each of these factors to the various classes of vehicles enumerated, a figure is obtained which, when reduced to the number of traffic units per hour or per minute per foot of available width of roadway, gives a reasonable estimate of the traffic density. In so doing this method also provides a common basis for comparison of the densities of traffic in widely different streets in the same city or in different cities and countries. The above reference to available width of roadway means the net width after deducting the width of the bases of elevated columns, isles of safety or any other fixed obstructions within the roadway.

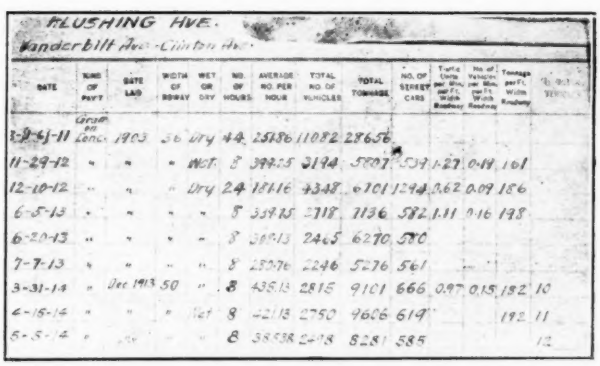
The traffic tonnage, together with the class of the vehicles borne by the street, is of considerable importance in determining the character of the pavement to be used. Even where pavement openings are quite numerous, the wear and tear is a big factor in the life of the pavement, provided always that restoration after opening is done with a reasonable degree of care. The weights here used were compiled after an extensive inquiry from many sources, including the largest shippers of goods and construction materials. Tables of traffic units and tonnage for each class of vehicle enumerated are here shown, Fig. 1, as well as a sample of an ordinary day's observations, together with a re-

port summary. The factors for traffic units, owing to the variable nature of the traffic and the intermingling of fast and slow vehicles, both loaded and empty, were not arrived at by computation but were established largely by observation. The figure 10 for street cars, owing to the size of the same and their being fixed rigidly in their line of travel, seems entirely reasonable. The same figure for trucks driving two or more horses might be considered large by some, but when it is remembered that this class includes a large variety of vehicles, such as moving vans, drays and trucks for lumber, coal, building and construction materials, frequently driving three horses, it is believed to be fair.

The weights used here are, of course, inclusive in every class of vehicle, including the weight of vehicle, the load, driver, horses, etc. The figure 9 tons for large auto-trucks loaded may appear to be rather above the mean for our heaviest class of motor-driven vehicle, but it must be remembered that there are a number of such vehicles in use with that number growing rapidly. There are a number of tractors with trailers now in use which weigh, with load, all told, 15 tons. It is necessary to thus dwell somewhat on these two tables, for upon them depends to a large extent the inquiry preceding pavement designs, based on a traffic census.

The assembling and indexing of the data secured are shown in Fig. 2. This index card gives a column for each of the quantities most used, except that of the percentage of motor-driven vehicles excluding street cars, which is placed in the remark column to the right. This card provides space for the entry of four or five years' records, thus providing a convenient traffic history of the street given. Some reports elsewhere have included a column for the number of vehicles per line of traffic, allowing about 8 feet per line. The writer does not believe this provides a good comparison for the densities on a number of streets the widths of roadway of which do not even nearly correspond to some even multiple of 8. For instance, the roadway of Fulton street, between Boro Hall and Flatbush avenue, is 42 feet, of which two lines of street cars require from out-to-out, 19 feet, leaving 11.5 feet for passage of vehicles on either side. This space is more than ample for one line of traffic on each side of the street cars, but not sufficient for two lines. In other words, the width of the roadway in excess of 34 or 35 feet is of so little value as to be negligible. Before the advent of our largest street cars and the increase in size of almost all other vehicles there may have been room for six lines of traffic in this roadway space provided for us by our ancestors, that is, if they gave such a matter any thought, which is doubtful. Nowadays, however, for such capacity a width of at least 50 feet is necessary. A glance at Livingston stret in the same vicinity shows this to be unquestionable. This, of course, brings out the fact that if Fulton street could have its roadway widened 4 feet on each side, for instance when the elevated railroad is reconstructed, an additional line of traffic in each direction could be accommodated, to the very great benefit of the public, particularly that fairly large portion of it doing business in the vicinity.

To revert once more to tonnage, it has


FLUSHING AVE.
Vanderbilt Ave.-Clinton Ave.

DATE	KIND OF PAVT	DATE LAID	WIDTH OF ROADWAY	WET OR DRY	NO. OF HOURS	AVERAGE NO. PER HOUR	TOTAL NO. OF VEHICLES	TOTAL TONNAGE	NO. OF STREET CARS	Traffic Units per Min. per Ft. Width Roadway	No. of Vehicles per Min. per Ft. Width Roadway	Tonnage per Ft. Width Roadway	% M.D.V. EXCL. S.C.
1-24-11	Gran. on Conc.	1903	36	Dry	44	2586	11082	28656					
11-29-12	"	"	"	Wet	8	3995	3194	5807	539	1.27	0.14	161	
12-10-12	"	"	"	Dry	24	1816	4348	9101	1294	0.62	0.09	186	
6-5-13	"	"	"	"	8	3995	2118	1136	582	1.11	0.16	198	
6-20-13	"	"	"	"	8	3013	2465	6270	580				
7-7-13	"	"	"	"	8	2507	2246	5276	561				
3-31-14	"	Dec 1913	50	"	8	4363	2815	9101	666	0.97	0.15	182	10
4-15-14	"	"	"	Wet	8	4213	2750	9606	619			192	11
5-5-14	"	"	"	"	8	3838	2418	8281	585				12

FIGURE II. *Index card, giving summary of data for point on Flushing avenue, affording room for records for several years.*

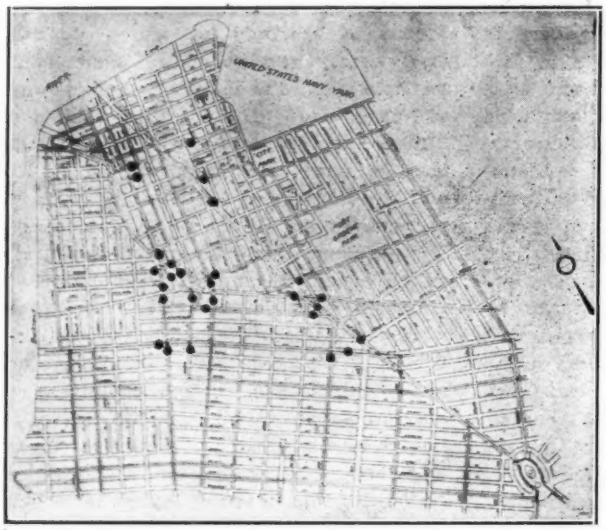


FIGURE III. *Map of the Brooklyn down-town district, the black dots showing the points of observation of traffic conditions.*

become quite the custom by some to refer to certain classes of pavements as being suitable for so many thousand tons per foot width per annum. It seems rather premature to attempt to make such an assumption until it has been proven after the lapse of the necessary time, that such pavement has actually lived its normal life under such a traffic. In other words, it would seem to be far safer to wait until we have a complete history of the given pavement which has actually worn out, especially its traffic-tonnage, before we can assume either the tonnage a given pavement will bear most efficiently, or the pavement most suitable for a given tonnage.

On some streets, due to width of roadway or location of and kind of street car rails, vehicles have a tendency to keep to one line, thereby gradually forming ruts, tending to the quick destruction of the pavement surface. This can hardly be avoided, but can be somewhat ameliorated by laws which fix the maximum loads per axle and the minimum widths of tires and diameters of wheels.

With some regard for the foregoing, we will now look at the special problem of congestion of all traffic in downtown Brooklyn. This problem was brought up very forcibly by the request of the court house commission that all street cars be eliminated from Joralemon street between Court and Fulton streets and from Livingston street between Court street and Boerum place. At or about the same time the proposition was advanced to remove the elevated railroad entirely from lower Fulton street, turning it into Adams street at about Boerum place and running thence to the present turn into the Brooklyn bridge terminal north of Tillary street. This will probably call for a double-deck structure from Myrtle avenue northerly. Adams street it is proposed to widen by taking about 100 feet on its easterly side. To make this 'L' turn it is proposed to take a part or all of the small triangular block between Fulton, Willoughby and Pearl streets. Of course, this whole proposition is part and parcel of the proposed improvement of the district between Boro Hall and Brooklyn Bridge. But with regard to surface traffic strictly, it may be possible to meet the desires of the court house commission and also partly remove the existing congestion and delay in this vicinity. To study this question properly, we, first of all, took a series of 16-hour traffic records at a number of important points in the district affected. These observations were taken between 6 a. m. and 10 p. m., subdivided into 15-minute intervals, the observers working continuously, in two shifts, two men at each point per shift. The points of observation are shown on the map of the downtown district by circles, Fig. 3. From these data, collected on a form shown in Fig. 4, were obtained the route and destination of every street car passing thru the district in each direction as well as the ordinary vehicular census. After computation of the results and plot-

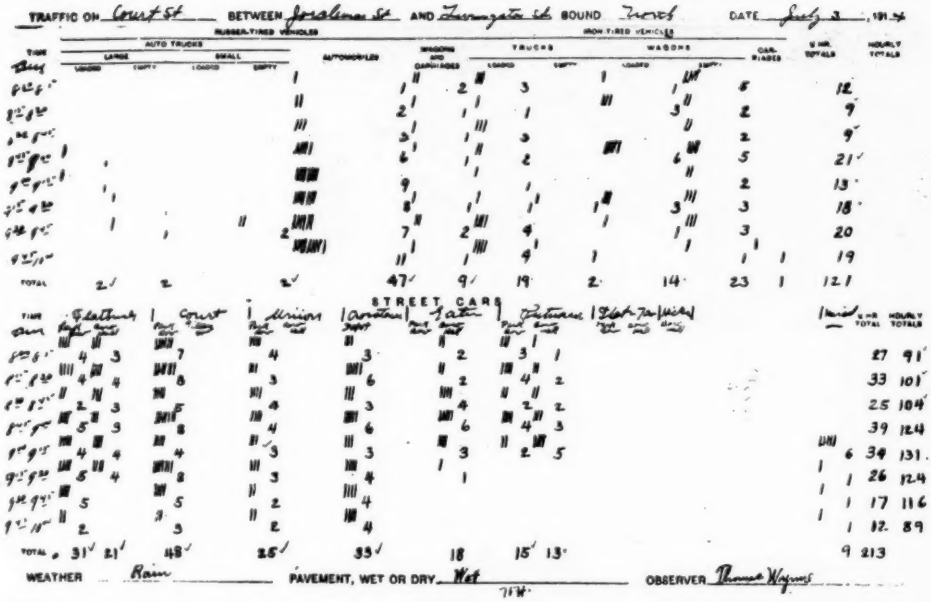


FIGURE IV. *Traffic count in Court street, showing route, direction and destination of every street car passing, as well as number of each class of vehicle.*

ting of the same we were in possession of the data to show the location and hour of greatest traffic density. This inquiry was supplemented by a few photographs, as follows, Fig. 5 being the first of these and indicating the nature of the information furnished by them:

Flatbush avenue, from State street to Fourth avenue, looking north; Flatbush

FIGURE V. *Photograph of Flatbush avenue from State street to Fourth avenue, indicating the nature of information given by photographs taken at listed stations.*

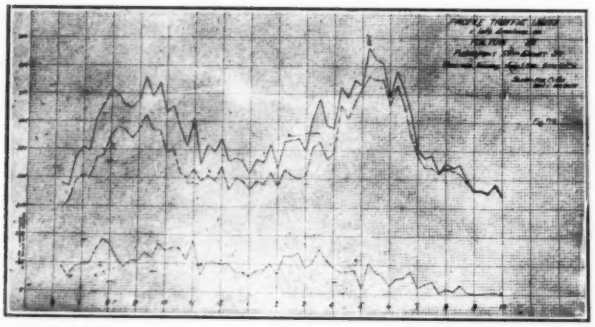


FIGURE VI. *Profile showing number of traffic units passing in each direction on Fulton street, from Pierrepont to Court street.*

avenue and Nevins street, looking north; Court street, from Remsen street to Joralemon street, looking north; Flatbush avenue, from Pacific street to Fifth avenue, looking north; Fulton street, at Bridge street, looking west; Fulton street, at intersection of Adams and Willoughby streets, looking west; Atlantic avenue, from Flatbush avenue to Fifth avenue, looking west; Court street, from Joralemon street to Livingston street, looking north; Court street, from Montague street to Remsen, looking north; Fulton street, at Pearl street, looking west; Fulton street, at Myrtle avenue, looking north.

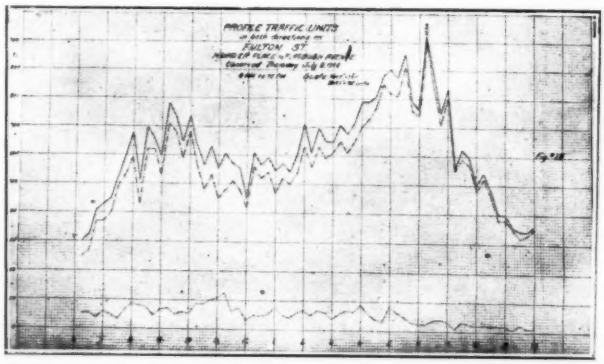
From the data thus obtained an analysis of the density and direction of all traffic was obtained and its control studied, first to obtain the particular results required by the court house commission, and second to reduce the congestion at certain important points; all of which must be done, of course, without serious reduction of the facilities now given the public nor at any very great expense.

From the profiles shown, it is easily seen that the congestion problem is one of street cars, the ordinary vehicular traffic being insignificant in comparison. From the rush-hour data is obtained a table of street car movements in both directions about as shown in Fig. 9. These are in numbers only, and in the adjoining column are the approximate figures obtained from the re-routing of street cars to overcome the difficulties complained of.

From the table in Fig. 9 we see the number of cars now passing the points given in both directions from 5 to 6 p. m. and in the adjacent columns the number called for by the proposed re-routing, together with the differences in number and percentages of reduction or increase as the case may be. By profiles it has been demonstrated what a large proportion of the total traffic density is due to street cars, therefore it seems fair to claim that a material reduction in numbers of the latter will achieve the desired result.

While the reduction of the amount of street car traffic at the most essential points may seem niggardly in this proposal, attention is drawn to the elimination of certain very bad intersections now existing, where it is believed a very material improvement can be expected.

FIGURE VII. *Profile of traffic units passing in each direction on Fulton street, from Hanover Place to Flatbush avenue.*



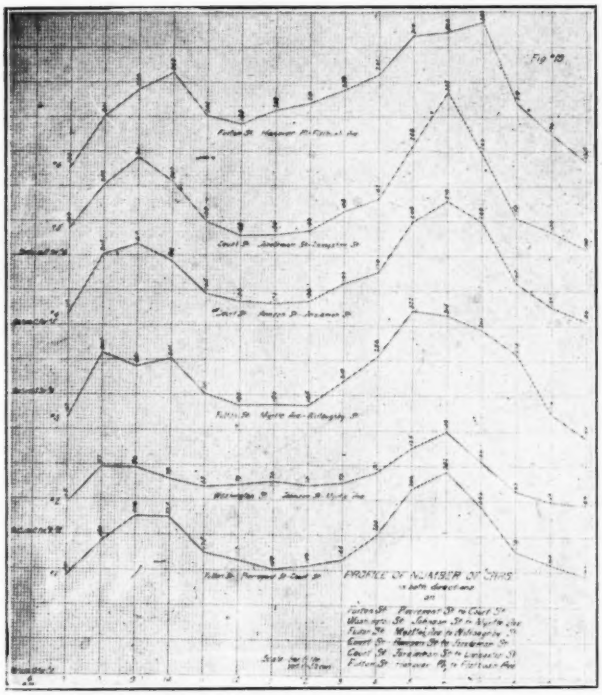


FIGURE VIII. *Profile of the number of cars passing in each direction on six streets on which observations were taken.*

Referring to the map, Fig. 3, the present crossing at Joralemon, Fulton and Willoughby sts. will be removed, as well as that at Fulton and Adams sts. and Boerum pl. The remaining northbound Park Row cars on Fulton st. between Myrtle ave. and Willoughby st. will continue straight north on Fulton st. instead of dividing as now, some proceeding north on Washington st. The third track on Court st. at Boro Hall likewise disappears.

Naturally enough these proposals do not consider the various questions, more or less legal in their nature, of trackage and franchise rights, but it is believed that, since the larger part of the rights of way, etc., are now under one control, it would not be difficult for the railway men and the city authorities to come to some agreement on the matter, equitable to all. Also this plan does not wait for the very large proposals for an approach to Brooklyn bridge to be worked out in their full detail. This plan does, however, offer a solution that can be quickly utilized as soon as the court house and elevated railroad problems are determined.

As regards this surface transit problem in general it is believed to be no worse than that encountered and solved in several other cities, of even much less population. The beginning of the now very comprehensive rapid transit system of Boston was the placing of its street cars in a subway under Tremont st. thru the center of the city. The city of Newark, New Jersey, has been able to obtain the construction of a large terminal for the relief of the public and better street car operation thru its streets.

FIGURE IX. *Table showing number of cars passing in each and both directions at fifteen points of observation and the number that would pass under re-routing plan, with increase or decrease in each case.*

Street	Limits	Existing			Proposed			Diff.	Per Cent
		N&W Bound	S&E Bound	Total	N&W Bound	S&E Bound	Total		
Fulton St	Pierrepont - Court Sts	110	173	292	93	109	203	89	30
Washington St	Johnson St - Myrtle Av	101	48	149	69	55	124	25	17
Boerum Pl	Fulton St - Livingston St	37	42	79	87	60	147	+68	+86
Adams St	Myrtle Av - Willoughby St	37	49	86	27	7	34	-52	60
Court St	Joralemon - Livingston Sts	140	195	335	69	76	125	-210	-63
Fulton St	Myrtle Av - Willoughby St	214	101	315	70	63	133	-182	-58
Fulton St	Hoyt St - Elm Pl	222	187	409	184	184	368	-41	-10
Fulton St	Pearl - Jay Sts	209	157	366	148	143	286	-80	-22
Flatbush Av Extn	Myrtle Av - Willoughby St	55	58	113	96	96	192	+79	70
Concord St	Washington - Adams Sts	23	19	42	23	97	120	+78	+186
Johnson St	Fulton - Washington Sts				34		34	+34	
Myrtle Av	Washington - Adams Sts	23	27	50	69	69	138	+88	+176
Sands St	Washington - Adams Sts	111	104	215	80	80	160	-55	-26
Jay St	Willoughby - Fulton Sts	32	32	64	102	102	204	+140	+219
High St	Washington - Adams Sts	52	31	83	74	-	74	- 9	-11

Concrete bridge built by Fulton county, Georgia, convicts. Forty feet span, sixty feet width.

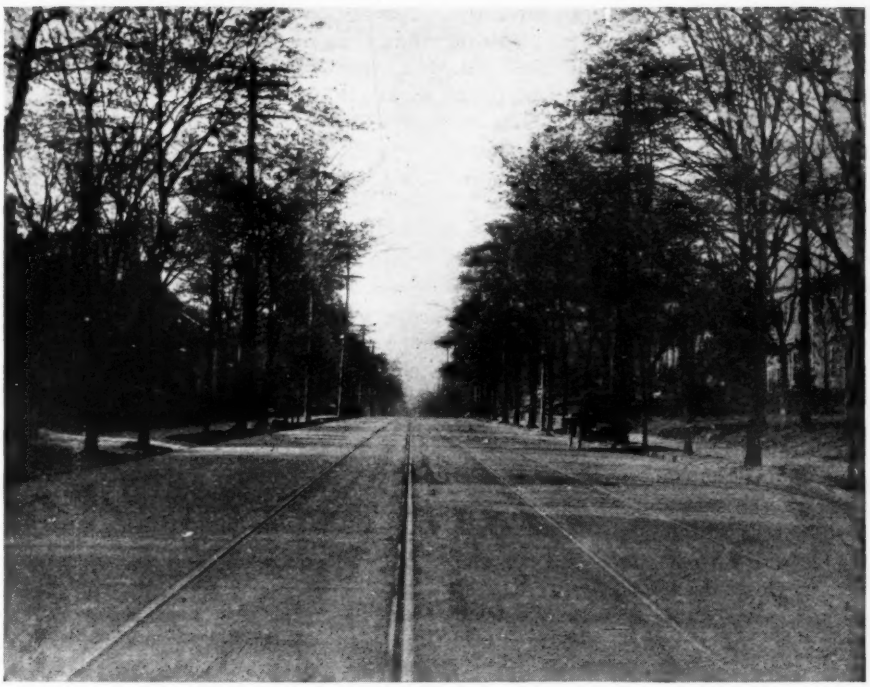
CONVICT LABOR ON COUNTRY ROADS

By George C. Warren, Boston, Mass.

The arguments in favor of using county jail and state prison inmates as laborers on construction and maintenance of country roads are forcibly put in an article prepared for the General Federation of Women's Clubs, from which this article is taken. Fulton county, Georgia, work is set forth in some detail because the author has means of knowing how that work is done.

IN these days of modern improvement, perhaps there is no economic question of greater importance or receiving more earnest consideration than that of more humane, industrial treatment of the unfortunate convicts and of making them more useful members of society.

The evils of contracting convict labor at low prices to manufacturers for producing goods for sale on the market, in competition with similar products manufactured by free labor, which was in general vogue in our State penitentiaries and county jails, have come to be well recognized and the practice quite generally abandoned. Labor organizations and others did well in their opposition to the contract convict labor system, but in their extreme opposition, they have at times improperly opposed all labor of convicts. As a result there has followed a period of maintaining the convict either in absolute idleness or not permitting him to perform work in the production of articles of which he can see a use. This is still the practice in many institutions. About twelve years ago it was the writer's privilege to spend a half day under favorable auspices in going thru the Elmira (N. Y.) Reformatory, which had the reputation, doubtless well earned, of being one of the best managed reformatories in the country. It was heart-rending to see the convicts taking their daily exercise, marching in line, back and forth, thru the prison yard. The yard was unpaved and consisted of compacted gravel. Occasionally a piece of gravel would become loosened and the duty of a convict, on seeing such a piece of loose gravel, was to pick it up and put it in his pocket. After the exercise of



PEACHTREE STREET, *near Eighth street, Atlanta, Ga., paved with bitulithic by Fulton county convict labor.*

an hour or so was over and before returning to their cells, the men would empty their pockets into a receptacle for the purpose. How nearly useless and how degrading is such employment! No work for production of goods for sale was permitted under the law, but the effort was made to teach men trades—carpentry, brick masonry, blacksmithing, etc. The men learning masonry, for instance, would one day build a wall about ten feet long and ten feet high, which the next day they would tear down and rebuild, going thru this operation in a little enclosure day after day. Could anything be designed which would be destined to cause a greater loathing for the brick mason's trade thus taught, than this perpetual accomplishing no useful end other than the mechanical education which, being enforced, the average convict probably does not appreciate?

But the most pitiable condition is when the convicts are released, after months or years of close confinement, as is still the custom in most of the penal institutions of the country, in a nearly dark, poorly ventilated cell; released with a grudge against the world; sullen in temper; sallow in complexion; broken down in health from sedentary habits and lack of work; given a very poor uniform suit of clothes, a few dollars in his pockets and thrown on the world, generally without friends, to find a job. The first question asked of an applicant for work is reference to his last employer. He must either lie, and probably be caught in the lie, or face the fact that ninety-nine times out of a hundred the prospective employer, even if he had a job to offer, will not trust it to a convict.

Is it any wonder that convicts, released under such conditions, take the little money given them by the State on release, and either make straight for the saloon or gambling den, if that has been their past infirmity, or use it to get a supply of burglar's tools, if their past efficiency has been along the burglary line?

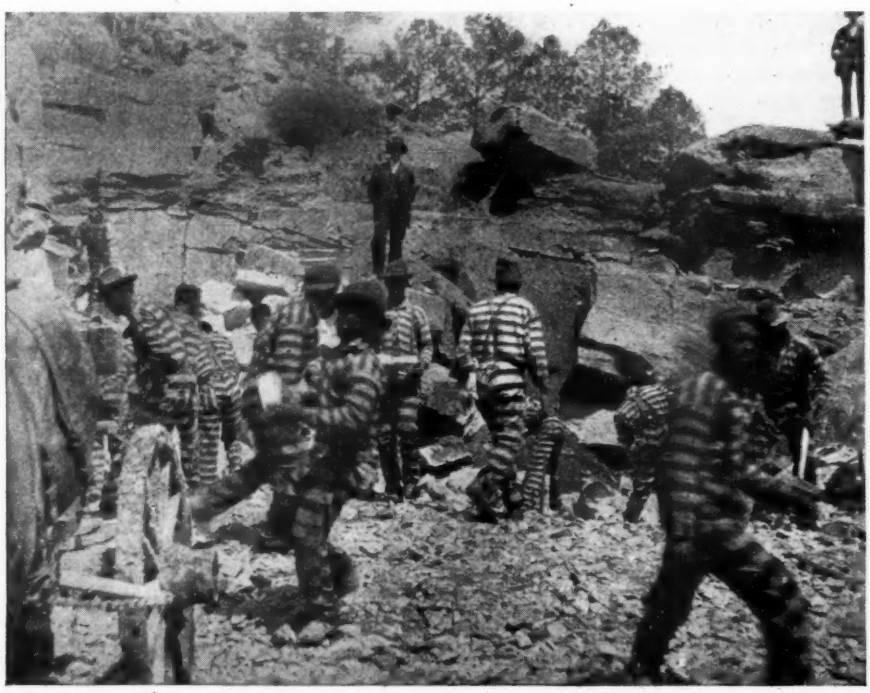
As a result of the general introduction of automobiles, both for pleasure and business purposes, with their destructive effect on the old types of road, the country is fast awakening to a realization of the fact that the country roads of the future must be as substantially built as city pavements.

In fact, the narrow country-road thorofare today carries a greater traffic per foot of width of improved area than fully three-fourths of the wider streets of any city. Congress has just passed a bill appropriating $5,000,000 per annum as a national aid to maintenance of State roads, but that large appropriation is not a drop in the bucket. The National Highways Association is energetically advocating the building by the Federal Government of 55,000 miles of highly improved country roads, including several stretches from the Atlantic to the Pacific, and from Canada to the Gulf of Mexico or Mexican border. Such national highways it is proposed should be built, maintained and owned by the Federal Government, leaving the states, counties and townships to build feeders into the national highways. Such a system of national highways, if well built, would cost approximately $800,000,000.

The state of New York alone has just completed the expenditure of an appropriation of $50,000,000. With this vast expenditure the New York State roads are as yet scarcely scratched over. Generally speaking, the work done has proved unsatisfactory and is rapidly deteriorating because it has been done too cheaply, in an effort to make the expenditure go as far as possible—much farther than it can be spread to meet the exacting conditions of the modern motor car and motor trucks.

Other states are rapidly adopting appropriations of corresponding large amounts as New York.

This immense development of modern country road construction and maintenance is a new industry—one for which a vastly increased amount of labor is



QUARRYING ROCK *in excavation for forty-foot roadway, with twenty-foot cutting, with Fulton county, Georgia, convict labor.*

GRADING *country road in Fulton county, Georgia, by convicts.*

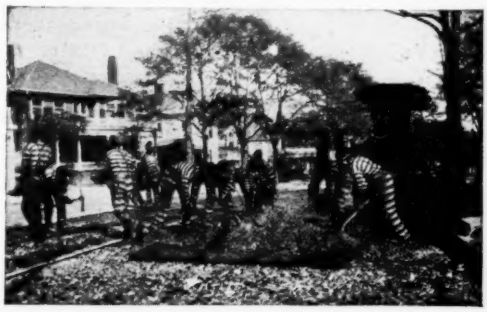
being required. It, therefore, does not compete with present employment of labor. Labor thus employed is not in the manufacture of articles for sale and thus put in competition with the product of other laborers. The national, state, county or township roads are built at the expense of the public, for the public use, and not for sale to anyone. What more fitting employment could there be for convict labor as far as such convict labor is available? On such employment the men would have good air, good useful exercise, and could each day see the product of their labor performing a use, which is a most important consideration to the moral welfare of the men after they have completed their sentences. On release they will have learned a trade at which they can immediately get employment on other roads without the ignominy of being asked where last employed. With that fair start each man would advance on his merits with his new employer and his past employment would be forgotten. In short, the ex-convict would be given a fair chance and a new start in the world, which he never can get under the convict system now in vogue.

This is no idle dream. It has been practically tried out in Colorado, New York, Washington, Oregon and other states, to a sufficient extent to prove beyond peradventure that it is practicable. In many cases, where the convicts are put on their honor, they respect the honor and become better and more industrious convicts and are destined to become better citizens on return to freedom.

Reports are published that in Missouri and elsewhere a certain amount per day of employment of the convict is paid to his family, so that he is thus enabled to contribute to the support of his family while in confinement. What an immense advantage that is to the convict's moral condition!

I don't know that it has been tried, but it seems to me entirely practicable to set aside for the benefit of the convict a certain amount of money per day of time employed while under sentence. It is suggested that the amount should be a reasonably full measure of the value of his service, less the cost of his support in confinement. Under wise supervision portions of such earnings should go to the family of the convict, if required for their reasonably comfortable support, and as much as possible set aside in a savings bank at interest so that when the convict is released the head of the penal institution can say to him, "You have been industriously employed....days and earned over the cost of your board $.....of which $.....has been given to your family for its support and here is a savings bank account for $.....covering the balance with interest. Engage yourself in some useful employment and the Lord will be with you in your effort to be a useful, industrious member of society." Contrast such a release with the present custom of setting an ex-convict adrift with a poor

CONVICTS *in Fulton county, Georgia, spreading Warrenite road surface.*



suit of uniform cloth, which immediately marks him as an ex-convict, and five dollars in his pocket with which to find his bearings.

An interesting article in the *Century Magazine*, entitled "The Next Step in Prison Reform," gives in detail a most interesting plan adopted in the Ohio State Reformatory under which convicts who are believed to be worthy of the trust are given employment on the prison farm, without physical restraint. When thus put on the farm the convict is handed a bond signed by the convict as principal and by the general superintendent of the reformatory as surety, the conditions of the obligation being as follows:

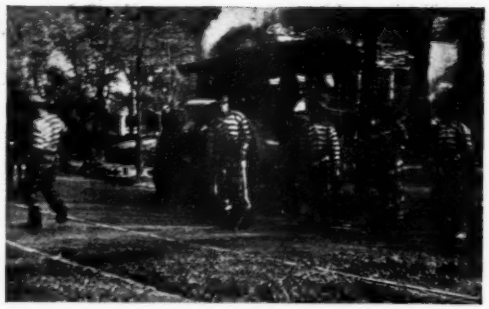
"Now if the said John Doe, Serial Number 5656, shall well and faithfully execute the trust thus reposed in him and shall observe and obey all the rules and regulations governing said trust, then this obligation with all penalties provided for in the rules and regulations shall be void, and on the release of said John Doe on parole from the Ohio State Reformatory, he shall be given this bond to keep and to hold as positive evidence to all concerned, not only of his good record as an inmate of the reformatory, but that he enjoyed the confidence and faith of the management on the grounds that in all things he conducted himself as becomes a man and a good citizen.

Witness our hands this 20th day of November, A. D., 1913.

John Doe,
(Principal.)
J. H. Leonard,
(Surety.)

Bonds like these are used when permitting an inmate of the reformatory to join the group of men who are employed without any physical restraint whatever, that is, when a man undertakes to regulate his conduct by inhibitory forces rather than to be subject of prohibitory stress. Since this system was instituted, ten years ago, the superintendent has signed more than 2,600 such bonds, and only eighteen of this number have been dishonored.

At the same time the convict is handed a pass which reads as follows:



ROLLING *Warrenite road surface in Fulton county, Georgia, using convict labor.*

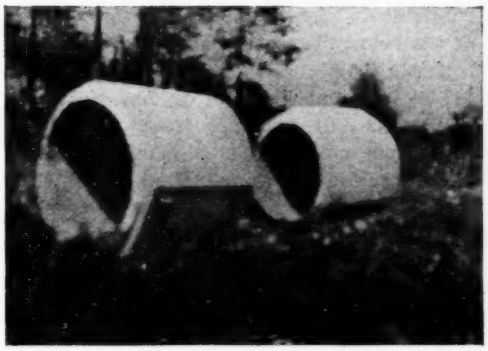
"In giving you this pass, I give you my confidence. I am sure you will fully appreciate this opportunity to demonstrate not only to me, but to the board of managers and to your friends who await your restoration to freedom that you have the self-control, the respect for law, and the proper regard for your word of honor that justifies us in permitting you such a large measure of freedom. Remember, when tempted, that trustworthiness is the red-book of character."

It is reported by Mr. Barry that:

"During the ten years that the system has been in operation in the Ohio reformatory twenty-six hundred prisoners have been allowed to work in the open without guard. Only eighteen have ever attempted to escape. The others preferred their healthy, interesting work in the open, and the bond and the card."

Fulton county, Ga., surrounds and includes the city of Atlanta, as Allegheny county, Pa., surrounds and includes Pittsburg. On account of the large assessed valuation of these large, enterprising cities, the counties are highly favored in the moneys available for road construction and maintenance, in consequence of which they have always been in the foreground of communities having a large mileage of high-grade road construction well maintained.

Fulton county has for many years employed its convicts exclusively in its highway construction. It has been the privilege and pleasure of the writer to closely follow this convict-labor highway



REINFORCED CONCRETE PIPE, 48 *inches in diameter, made by Fulton county, Georgia, convicts.*

construction in Fulton county, which not only includes the building of roads, but also the quarrying of stone for use in the roads and concrete construction, the building of concrete bridges and bridge abutments, laying of sewers, manufacture of cement concrete pipe, street grading, etc. In short, everything which is required in high-class road construction which can be built locally.

The writer is indebted to Mr. W. T. Wilson, C. E., engineer of Fulton county, for a series of photographs incorporated with this article, illustrating the convicts at work and the completed works constructed by convict labor.

It will be noticed by the photographs that in this case the convicts are all negroes and are in the usual striped uniform of penal institutions. It has been claimed by some that the striped clothing and their marking of the men is degrading and unnecessary. This is a matter of detail which could be easily changed if best and safe. Perhaps in this and other respects different treatment of white men in the North can be practiced than is practicable with colored convicts of the South. However this may be, there can be no question that, whatever the clothing, work on the public highway is far less degrading than idleness in a prison cell. Fulton county has several camps in different sections of the county where the convicts engaged in road construction are fed and housed in tents.

On the question of white vs. colored convicts, Mr. Barry, referring to a case of extreme cruelty practiced in a prison in Richmond, Tex., thru dark cell incarceration and flogging, says necessity for the treatment was claimed by the authorities because "the negro criminal was more difficult to deal with than any other kind, that he was less amenable to reason or restraint, and that he could be reached only thru his epidermis or his primitive imagination, which recoiled at the dark."

If it is true, as thus claimed, that negro criminals are most difficult to deal with, then Fulton county has solved the problem of outdoor employment under the most difficult conditions.

The following facts are gleaned from the most interesting and valuable "Annual Report of the Chairman of the Board of Commissioners of Roads and Revenues of Fulton County, Ga., for year ended December 31, 1913, by Shelby Smith, Chairman Board of County Commissioners":

"There had been an average of 680

CONCRETE SEWER *of fourteen feet diameter, built by Fulton county, Georgia, convicts.*

male convicts under control of the county during the year 1913, and they have been engaged on the public works of the county and the city of Atlanta....The total estimate of work done by the department amounts to $766,340.87."

The amount of work of several classes by the employment of convict labor during the year 1913 is officially reported as follows:

Roads graded during 1913, 16.9 miles, and miscellaneous grading, at a cost of	$105,404.98
Roads paved during 1913, 9.13 miles, at a cost of	185,007.65
Roads resurfaced during 1913, 3.55 miles, at a cost of	10,152.10
Roads oiled during 1913, 50.64 miles, at a cost of	27,427.92
21 bridges rebuilt and repaired during 1913, at a cost of	7,744.93
General road repair	49,640.00
	$385,377.58

"Of a total of 640 prisoners confined for month or period ending December 24, 1913, there were only four under the care of the physician."

"The Board authorized the committee on public works to install shower baths at the county barracks for the use of the convicts."

OUTLET *of trunk sewer of fourteen feet diameter, built by Fulton county, Georgia, convicts.*

The National Free Labor Association, having its offices at 832 Broadway, New York, has published a 50-page bulletin, "Road Making by Convict Labor," which contains a series of extremely interesting articles and statistics and excerpts from reports and laws on this important subject. The following extracts are of special interest: An article by Julian Leavitt, "Good Roads and Better Men," contains the following:

Good roads are a crying necessity in this country. But until now the cost of building them has been prohibitive. We have scarcely begun to realize that in our 1,400 prison houses we have stored the labor power of 100,000 men and boys, truly an army of liberation if only applied to good purpose. I have shown elsewhere how this great mass of human energy is permitted to degenerate in the cell until it poisons not only the immediate victim, but the rest of society. Now let me tell a pleasanter story of how a few wise administrations have begun to harness this force to a great communal purpose."

Then follows statistical information from Colorado, Montana, Oregon, Maryland, Georgia, Louisiana, New York, New Jersey, Arizona, Missouri, Kansas, California, Ohio and Vermont, all of which states have successfully tried out the employment of convict labor on the country roads. The article concludes with the following:

"Here, then, is a complete road program for any state:

"First, abolish the contract system, both in the prison and on your roads.

"Second, classify your prisoners into three groups.

"A. The honor group, consisting of trustworthy, good-conduct men, whose sentences are short or within sight of expiration date—i. e., the tried men who have little to gain and much to lose by attempting to escape.

"These men may be put on road work anywhere within the state.

"B. The trusty group, consisting of good-conduct men whose sentences are

long and far distant from expiration date —i. e., men to whom the temptation to escape may appeal powerfully, but who have demonstrated some capacity to resist it.

"These men may be put on road work in the vicinity of the prison.

"C. The remainder, who cannot be trusted.

"These men may crush rock and prepare the road material for the use of the other groups, but within the prison walls.

"Third, organize your road forces with the advice and under the superintendence of competent road engineers from the State Highway Department.

"Fourth, co-operate with the county authorities by exchanging prison labor for county food and equipment."

An article, "Solution of the Convict Labor Problem," contains the following:

"At its biennial convention in 1912, the General Federation of Women's Clubs passed a resolution declaring itself 'as opposed to the contract system of prison labor, and to every other system which exploits this labor to the detriment of the prisoner; and that we urge upon the several states the advisability of establishing outdoor work for able-bodied convicts, remedial care for the feeble and degenerate, and industrial education for all who have the potentiality for reform ....The product of the convict's labor should be consumed by the state, and the profit therefrom, above the just cost of his keep, should be used to support such dependent family as he may have."

The New York State Commission of Prisons reports:

"Your committee believes that road build by the convicts, if it receives the c eration of the officials and the men n charge, can be made profitable to t county and town, and at the same time show earnings for the penitentiary er than heretofore shown."

Col. Edwin A. Stevens, State Road Commissioner of New Jersey, after one season's trial of convict labor on the roads of his state, is enthusiastic in endorsing the policy generally. In a communication to the A. A. A. National Good Roads Board, the Commissioner writes:

ELIMINATING GRADE CROSSING *by lowering grade of highway, work done by Fulton county, Georgia, convict labor.*

"The experiment of convict labor on state roads, which was proved to be a success in one week, is only the beginning of good road building beyond what we already have and at a price which will spread out the money of the state beyond its present confines."

The attitude of organized labor toward road building by convicts is shown by the following facts:

President Gompers, of the American Federation of Labor, says: "Prisoners should be employed at useful and practical productive toil. The labor of the state's unfortunates and derelicts should never be exploited for profit, and certainly never for the private profit of contractors. Let our states employ their prisoners in the production of the necessaries of life, for the maintenance of themselves and the inmates of the other state eleemosynary institutions, or else road building."

John J. Sonstesy, of the United Garment Workers, in the Proceedings of the National Conference of Charities and Correction, 1912, page 222, says, in regard to the question of road building by convicts:

"Many people think that the only alternative to abolishing the contract or lease system is idleness for the convicts. That this is not true has been proved in the places where the contract and lease

systems have been abolished. Every convict who has no trade and is capable of learning one should be taught one most suitable for him to make him an efficient, intelligent mechanic, and able to follow the trade when he is released. In the arrangement of employment for the prisoners the state should endeavor to supply itself with everything necessary in its various institutions. A large farm should be operated, and all other necessary plants for the turning of the different raw products into the finished articles needed in the various state institutions. The making of roads is an ideal occupation for convicts."

The New Jersey Federation of Labor passed the following resolution:

"Resolved, That the New Jersey Federation of Labor urges upon Fielder, so far as he is able, to develop the state use and road work system, and so far as possible continue the policy laid down by his predecessor, President Wilson, on this important subject, and they request him to refuse to renew or execute any new contracts for the work of prisoners or permit the present contracts to be extended."

John P. Frey, of the International Molders' Journal, says:

"The trade-unions have never advocated that convicts should be kept in idleness, instead they have insisted that convicts should be employed and that the convict's reformation would be impossible without useful and healthful labor...

"It is not the work of the convicts as producers which meets with trade-union opposition, or that by working they may keep some free men idle. It is the methods by which prison labor, when performed for the benefit of private contractors, places the convicts' labor on the market, and thereby forces reductions in wages upon large numbers of free workmen and, by so doing, lowers their standard of living.....

"For years the trade-unions have endeavored to have the convicts employed out of doors as much as possible, where the sunshine and pure air would build up the physical man and give that rugged health which would enable the unfortunates upon their release to have clear heads and strong bodies, instead of being the pallid wrecks which so often leave the prison door, nerveless, spineless and unfit to undertake the task of reclaiming their places as useful members of society or to properly support themselves thru their labor.

"The trade-unions insist that convicts shall be employed, but they are equally insistent that their labor shall be performed under conditions which will tend primarily toward their reformation....

"There is much work requiring the use of both brain and hands which is necessary in connection with the maintaining of our state and eleemosynary institutions which could and should be done by convicts. There are highways to build, there is farm produce to be provided and the convicts can do all of this with a minimum of competition with free labor and with no injury to the farmer.

"For this work the convict should be paid by the state so that he may be made to realize that the state does not rob him of his labor, a common impression among the convicts today, but that his confinement has been made necessary for his own good and the safety of society, and that during this confinement society is discharging its obligations to him, giving him an opportunity of reformation, end enabling him to earn money which will save him from actual

CONCRETE ABUTMENTS *built by Fulton county, Georgia, convicts in eliminating grade crossings.*

want upon his release, and what is equally important, enable him during confinement to provide for those who are dependent upon him and who without his assistance are forced in many instances to depend upon private charity."

Referring again to Fulton county, the experience proves that the very highest and most modern types of road construction requiring expert labor and technical skill can be built successfully with convict labor at a minimum cost. The types of road which can be most economically built by convict labor are those which are made as largely as possible of crushed rock. The manufacture of road materials at penitentiaries, shipping the materials thus manufactured by rail to point of use, is undesirable and uneconomical because:

First—Such types of roads require an undesirably heavy investment in manufacturing plant.

Second—An unnecessary and heavy outlay of cash is necessary in transportation of the manufactured product from the penitentiary to the point of use.

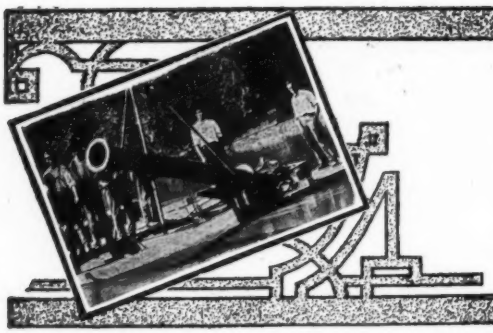
The entire tools and machinery of Fulton county employed by its public works department, including quarry and street tools, wagons, grading outfits, steam rollers and complete Warrenite mixing plant, is inventoried at only $50,500, with which, as noted above, it completed public works in 1913 aggregating $385,377, so that the road construction of 1913 aggregated nearly eight times the value of equipment used thereon.

Of course, it must be borne in mind that convicts who are physically incapacitated, either because of age or other infirmity, or because of lack of prior muscular development, cannot be well put at manual labor. As someone has said: "You cannot suddenly turn a bank president into a laborer with a pick and shovel, and expect him to perform much work." In road construction, ever, there is a great deal of employment which is not manual labor, such as time-keepers, material men, watchmen, etc., and it is believed that, as in the business world of free labor, a place can be found on road construction for all classes of convicts, each placed in the department of the work which he is best fitted to fill.

In conclusion, if the entire 100,000 men and boys reported to be now confined in 1,400 prisons, distributed thruout the United States, were employed in road construction, the number so employed in most of the communities would be but a small proportion of the total labor required, and would be so infinitesimal in its effect on free labor similarly employed as not to be felt.

"Organized labor," freely quoted above, is to be congratulated in the humanitarian attitude it is now generally taking in favor of the employment of convicts on outdoor work, preferably on country roads.

ROAD GRADING *with outfit of four-wheeled scrapers, using Fulton county, Georgia, convict labor.*



EDITORIAL

BUILD NOW.

The evidences of early resumption of activity in all lines are increasing in number every day and it is the duty of the managers of business of all sorts to prepare for the rush which will soon follow the opening of the gates. The present inactivity has thrown many men out of work and the depression has affected the prices of construction materials of nearly all kinds, so that the present is the best time for placing contracts including both labor and materials which this country has seen for many months, and the best which it will see for some years in the future.

Prices and terms are the lowest and best possible, and it is only common business foresight to take advantage of them. Notwithstanding the exceptional reasons for a foreign demand for money, there is plenty of money available, perhaps at a reasonable increase in rate of interest, for legitimate enterprises. It really seems that most corporations have money on hand or readily available for whatever seems to be legitimate expansion. It takes only a little courage to back the conclusion, which must be drawn from a study of the demands of the near future in the light of the present conditions, that within a very few weeks business will open with a vigor which will tax all present facilities and demand more.

Economy demands that advantage be taken of the present low prices of construction materials and labor to make the additions to present buildings, machinery and supplies, so that when the rush does come and neither time nor men are available and prices of materials have begun to soar, the plant will not be swamped and the profits will not be cut off because of lack of room and facilities for handling the business.

Every great war has been accompanied or followed by a great increase in business activity and, so far as the United States is concerned, the effect of the present war is already felt in this direction.

Municipalities in particular should take advantage of the present conditions for the same reasons and for two other reasons, equally good, tho not so lasting. One of them is that the city may give employment to those who are now out of their usual line, and available at lower prices than usual for city work. The other is that, while cities usually do not have the money in hand to pay for work, they can at this time raise money on more advantageous terms than any one else. As already stated, there seems to be plenty of money available for safe investments and just now municipal bonds are the first choice of investors, because they are safe and therefore can be turned into cash with reasonable facility upon occasion and have the additional attraction of a slightly increased rate of interest over that prevailing in the past.

MUNICIPAL ENGINEERING can hardly fail to chronicle the adoption of plans for and the beginning of construction of many extensions of present plants and new public and private improvements in the February number, and fully expects its annual spring construction number to be the largest and to show the most extensive prospect of work for the season which it has ever found to record.

HOME RULE FOR CITIES.

An Englishman, William Harbutt Dawson, has recently published a book on "Municipal Life and Government in Germany," which compares the practical home rule of German cities with the carefully supervised governments of English cities to the advantage of the former. It appears that the central government has equal power in the two countries over the detail of the operation of cities, but the German government seldom exercises its control except in matters directly concerning the central government itself or its national political policies, whereas the English government, thru various national boards and thru Parliament itself, interests itself in the smallest details of the administration of its cities and keeps them in such close lines of action that they may almost be said to have no actual powers of their own.

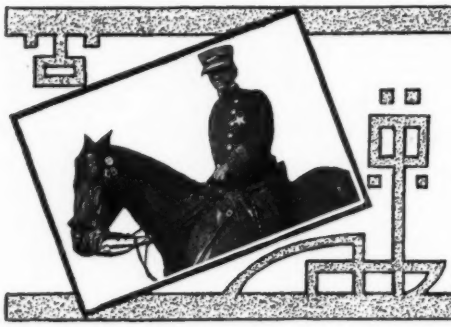
German cities are subject to all the difficulties arising from bi-cameral city councils, entire independence of appropriating and spending authorities, interference of councils with appointments to office, and, on occasion of interference of the state government with all these matters, from which American cities have been trying to free themselves by means of centralization of power in the mayor, the commission form, the city manager, the commission-city manager and their numerous modifications, but by the application of three principles they have been able to develop what is perhaps the most efficient of city management, if judged by results. These three principles are: The separation of municipal elections from partisan politics so that the city council and all officers are selected without control by any political organization; the selection of the administrative officers by a strictly merit system, with the result that municipal office holding is as much a profession as teaching, and officers are selected from any locality within the empire where the most competent and most suitable men can be found; and the practical operation of home rule, which, when properly applied, includes both the other principles.

American cities will do well to study the application of these principles in their own government, as exemplified by the German cities, and may then discover that the true course of improvement in municipal conditions is not so much in the change in form of government as in the full application of these three principles, all of which are recognized by the students of these problems, but none of which have had their full opportunity to demonstrate their value in our own cities.

The annual report of the Director of Public Works of Philadelphia, Morris Llewellyn Cooke, published last summer, is unique in its manner of discussion of the problems of city management and shows many of the lines in which the principles stated can be and should be applied, and reports the measure of success which Philadelphia has attained where it has been permitted to apply them.

Both these publications are well worth the detailed study of those whose hearts are in the search for a solution of our municipal government problems.

January, 1915.



QUESTION DEPARTMENT

Articles on Good Roads

I would like a list of the articles on good roads appearing in MUNICIPAL ENGINEERING during 1914.

P., Washington, D. C.

Following is a list of the principal articles on roads and streets which appeared in MUNICIPAL ENGINEERING during 1914, those on pavements having close relation being included, as street pavements are now required on many main highways.

In vol. xlvi:

January: Paving Methods in Baltimore, p. 2; New York State Highway Specifications, p. 33; Highway Maintenance in Indiana, p. 34; Stone-Gravel Roads Costs, p. 52; Asphalt Pavements in Buffalo, p. 56; Brick Pavements in Buffalo, N. Y., p. 58; Motor Trucks in Street Work, p. 59; The New York State Asphalt Inquiry, p. 67; Creosoted Wood Block Paving in New York, p. 71; Pavements of Rome, N. Y., p. 84.

February: Pavements of Trenton, N. J., p. 102; The Relative Economy of Constructing Bituminous Pavements by Penetration Methods, p. 146; Report on Concrete Roads in Wayne County, Mich.; The Construction of Creosoted Wood Block Pavements, p. 152; Economical Plant for Handling Gravel for Road Building, p. 153; Cutting Down Hauling Costs, p. 165; Asphalt Pavements in New Orleans, p. 177; Trinidad Asphalt Streets in Indianapolis, p. 179; Aztec Asphalt Pavements in Scranton, Pa., p. 182; Permanency Is Keynote in Modern Road Building, p. 184.

March: Motor Dumping Trucks, American and German types, p. 202; Aggregate for Concrete Roads, p. 213; The Maintenance of Concrete Roads; Methods and Cost of Repair, p. 217; Building and Maintaining Roads for the Traffic, p. 234; The Importance of Highway Maintenance, p. 259; Method of Constructing Concrete Pavement, p. 261; Tarred Concrete in Portland, Me., p. 265; Aztec Asphalt in Baltimore Pavements, p. 280; Fifth Avenue Pavement in New York, p. 282; A Portable Plant Laying Asphaltic Concrete Pavement, p. 289.

April: The Municipal Asphalt Paving Plant of Spokane, Wash., p. 304; Bituminous Pavements in Wilmington, Del.; Concrete Alley Pavements, p. 311; Methods of Paving Construction in Baltimore, Md., p. 326; Brick Pavements, Their Maintenance and Repairs, p. 331; Roads to Be Constructed During 1914, p. 348; Road Grading in Counties, p. 352; Sidewalks in County Work, p. 355; Curb and Gutter on County Roads, p. 358; Drains for County Roads, p. 362; County Road Bridges, p. 369; County Road Signs, p. 373; Indiana Spends Fourteen Millions a Year on Roads, p. 384; Old Asphalt Pavements, p. 392; The Tractor for Heavy Hauling, p. 393; Government Supervision of Road Maintenance, p. 394; Revision of Manufacturers' Specifications for Brick Pavements, p. 394; Creosoted Yellow Pine Block Pavements in Dallas, Texas, p. 395; Large Road Contract in Greene County, Tenn., p. 403; Aztec Liquid Asphalt for Oiling Roads, p. 403; Smith Hot Mixer in Annapolis, p. 406.

May: Granite Block Pavements Recut to Small Size and Relaid, p. 426; Bituminous Road Construction, a Report of English Experience, p. 440; Laying Wood Paving in London, p. 446; Melting Point Tests of Bituminous Materials, p. 471; Concrete Road Construction in Indiana, p. 472; The Principles of Scientific Management as Applied to Highway Engineering, p. 474; Permanent Road Construction in the United States, p. 476; Prison Labor on Roads, p. 477; Motor Truck Service and the Public Roads, p. 485; Trinidad Asphalt for Maple Road, Indianapolis, p. 489; Aztec Asphalt, p. 492; Creosoted Wood Block Paving in Jersey City, p. 492; The M-C Paving Mixer, p. 494.

June: Reinforced Concrete Trestle in California Highway, p. 517; German Motor Trucks and Trailers, p. 528; Concrete Roads in Illinois, p. 534; Progress of the Asphalt Industry, p. 563; Modern Bituminous Surfaces and iBtuminous Pavements, p. 566; Good Roads a Factor in Real Estate Values, p. 569; Concrete Paving for Buhl, Minn., p. 569; Road Bee Day in Michigan, p. 574; Tractors on State Roads, p. 574; Asphalt Plant in Use on Road

Work at the Ashokan Reservoir, p. 576; Loss of Time in Unloading Gravel, etc., Eliminated, p. 577; Some Modern Developments in the Asphalt Industry, p. 579; A Tractor with a Heavy Load, p. 580; Joint Protector for Concrete Pavements, p. 581.

In vol. xlvii:

July: The Bitulithic Pavement, p. 2; Who Supplies Novaculite, p. 47; Voids in Crushed Stone, p. 47; Burned Asphalt Cement Can Be Prevented, p. 49; Buckling of New Brick Pavement at Elmira, N. Y., p. 50; Empirical Requirements in Asphalt Specifications, p. 51; Variations from the Standard Asphalt Specifications, p. 53; Slab Tests of Brick Pavements, p. 54; Bituminous Concrete in the Roland Park, Guilford District, p. 56; Concrete Roads and Streets in the United States, p. 61; Better Roads Cut Living Cost, p. 62; Efficiency in Road Building Equipment, p. 69; Montreal's Portable Asphalt Paving Plant, p. 73; The South's Good Roads, p. 74; Hot Penetration Road Oiler, p. 75; Semi-Portable Bituminous Mixing Plant, p. 76; Condition of New Jersey Roads, p. 80.

August: Bitulithic on Macadam on Marlboro Street, Boston, Mass., p. 90; Good Roads as Crop Producers, p. 109; Economic Side of Good Roads Days, p. 120; Burned Asphalt Can Be Prevented, p. 125; The Perfection of the Modern Street Pavement, p. 148; Evolution of a Business Street, p. 150; The Cost of Good Roads, p. 151; A Ribbed Arch Highway Bridge, p. 152; Objects of the Indiana State Highway Commission, p. 153; The Passing of the Road Boss, p. 155; Re-inforced Concrete Street Paving, p. 165.

September: The Municipal Asphalt Plant of Chicago, Ill., p. 184; Pavement Economy, p. 190; Expansion Joint in Alley, p. 214; Burned Asphalt Quite Unnecessary, p. 216; Buckling of New Brick Pavement at Elmira, N. Y., p. 221; Relation of Traffic and Cost of Maintenance of Roads, p. 225; An Unsupported Brick Highway in Continuous Use, p. 227; Asphalt Repairs in St. Paul, Minn., p. 229; European Rock Asphalts, p. 230; Fibered Asphalt Pavements, p. 234; Using the Motor Truck, p. 249.

October: Methods of Unloading Tank Cars, p. 256; Portable Asphalt Plant Resurfacing Macadam Road in Chicago, p. 263; Topeka Specification Asphaltic Concrete, p. 292; Burned Asphalt Cement Can Be Prevented, p. 294; Putting Paving on a Systematic Basis in New Orleans, p. 297; Repairing Concrete Pavements, p. 297; Laying Concrete Pavement, p. 298; Slag for Road Paving, p. 300; Calcium Chloride in Road Maintenance; Removal of Wood Block Troubles in Europe, p. 303; Street Paving in Des Moines, Iowa, p. 304; Division of Roads for Traffic, p. 305; Recent Granite Block Pavements in Philadelphia, p. 306; Increase in Use of Concrete Pavements, p. 308; Guide Post in England, p. 308; A Brick Road as a Monument; Good Roads Movement in Northern Illinois; Lighting the Lincoln Highway, p. 321; The Buffalo Brick Convention, p. 322; Bermudez Road Asphalt.

November: Recut Granite Block Paving in Bronx Boro, New York City, p. 344; Gas Leaks Under Bituminous Pavements, p. 351; Vitrified Brick Street Construction, p. 364; City and County Highway Drainage, p. 371; Motor Trucks for Market Delivery, p. 391; Repairs to Concrete Pavements, p. 393; Paving with Small Granite Blocks, p. 393; Cost of Supervision of Highway Construction, p. 395; The Filler for Brick Pavements, p. 399; Improvements in American Paving Practice Suggested by European Experience, p. 400; A Refrigerator Motor Truck for Dairy Products, p. 412; Wire-Cut-Lug Brick Has Phenomenal Popularity, p. 412.

December: Bituminous Macadam Roads in Rhode Island, p. 430; Motor Truck for Oiling Roadways, p. 442; Concrete Streets on Steep Grades in Mankato, Minn., p. 451; Rochester Can Specify Biutlithic, p. 455; New Municipal Asphalt Plant at Pittsburgh, Pa., p. 460; Increase in Asphalt Production, p. 463; Asphaltic Materials for Road Consrtuction, p. 464; Recut Granite Block Pavements, p. 467; Reinforced Concrete Pavement Foundation Over Trench, p. 471; The Development of the Road Paving Plant, p. 479; Clark's Traction Grader, p. 481; Street Signs and Sign Posts, p. 482; Steam Melting Asphalt Plant, p. 484.

Laying Vertical Fiber Brick Pavement

We have up for consideration now before our city officials a proposition of paving a street 30 feet wide, 3,900 feet long, with vertical fiber paving brick blocks. These are to be laid on old macadam base. At present the street has 9-inch crown but is very irregular. Curbs are in good condition.

I have never had any experience with this kind of paving material, and if consistent would like to have your opinion on the following questions:

Will vertical fiber vitrified brick blocks stand 18 per cent. test on 1911 rattler with 300 pounds cast iron foundry shot 1,800 revolutions per hour for one hour?

Just how should asphalt be flushed on and how much asphalt per square yard should be used where paving is laid on 1½-inch sand cushion?

Could above described street carry more than 6-inch crown to be 2 inches higher than curb and give satisfactory service and be consistent with good workmanship?

J., ———, Mo.

There is no reason why the vertical fiber paving blocks should not stand the same rattler test as blocks made from the same material in the ordinary form.

The question is therefore one of the particular make of brick, as to material, method of manufacture, manner of burning, etc., and brick of either fashion may be subjected to the same tests and accepted or rejected under the same specifications.

The usual method of applying asphalt filler is to pour it hot into the joints from a can thru a spout so as to spread as little of the asphalt on the surface as possible. The amount of asphalt or other filler used will depend on the design of the lugs on the blocks and the closeness with which the bricks are laid to each other. One gallon per square yard is a rough estimate of the amount required.

The tendency with the modern kinds of traffic is toward flatter crowns so that the traffic will distribute itself better over the whole width of the pavement. A 9-inch crown causes the traffic to keep on the center line as much as possible. Perhaps the crown can be reduced somewhat if care is taken, in taking the inequalities out of the surface of the old macadam, to cut down such projections as appear in the crown of the old roadbed and fill such inequalities as appear near the gutter. The old macadam may be enough thicker in the center to permit cutting it off an inch or two, which may be all that is actually necessary to bring the crown down to 6 inches. Perhaps the gutters can be filled a little. However, the new surface of the street will be raised by 4½ inches, the thickness of brick and sand cushion, and it may be difficult to take care of the drainage with any more fill in the gutter. The difficulty in laying a brick surface on an old macadam base usually occurs at this point.

If the street is very nearly level, the crown may be 6 inches or even a little more for a 30-foot street, tho it would be better if less, but if it has a considerable slope longitudinally the crown should be still less.

Ordinances Regulating Street Excavations

I will appreciate it very much if you will send me copies of latest approved ordinances regulating excavations and improvements made by gas companies in public streets and thorofares. I desire in particular, if possible to procure the same, an ordinance where the gas company is required to deposit a forfeit and the city does the work at the expense of the company.

S., ———, Tenn.

The writer does not know of any city in which the city makes excavations for laying or repairing gas pipes or connections and replaces pavements at the expense of the gas company. A few cities having municipal street repair plants relay the street surface at the expense of the company. Can any of our readers cite ordinance or contract such as our correspondent desires?

Such regulations regarding connections made for plumbers with municipal pipe systems, whether water, gas or sewer, are in operation, but very few cities go farther than to require a plumber wishing to make such connections to make a deposit or file a bond to cover any expense which the city may incur in correcting his errors in making such connections and replacing pavements.

In MUNICIPAL ENGINEERING, vol. xlii, p. 185, will be found a rather new franchise for a gas company, which contains about the only form of requirement usually made, this one to the effect that "if said changes are not promptly made within a reasonable time after such notice, the city hereby reserves unto itself the right to remove all such conduits, appurtenances and apparatus from such streets, alleys or public grounds and collect the cost and expense thereof from said company. And if said company shall not promptly pay such costs or expenses on demand, the same shall be taken and held by the parties to be grounds for the revocation of the rights and privileges of said company on the streets, alleys and public grounds affected."

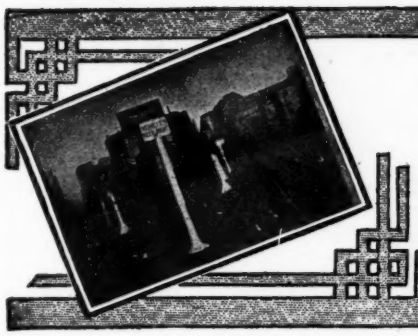
Specifications for Park Road

I would like specifications for a park road, 16 to 18 feet wide.

F. M. S., Peru, Ind.

Specifications have just been issued by the American Society of Municipal Improvements for gravel and macadam roads which are proper for park driveways. Waterbound macadam with or without bituminous surface treatment afterward and bituminous macadam by the penetration method are covered by these specifications, and choice should be made among them according to the amount of traffic the restrictions put on the kinds of traffic that may pass over the road and the money available for the work.

Six sets of specifications which have been adopted by the society, those for asphalt, brick, concrete, macadam and gravel, and stone block pavement, and sewer construction and one, wooden block pavement, which has not been adopted, are now ready for distribution at 25 cents each, and will be followed later by an eighth, bituminous macadam, not yet adopted by the society. These specifications can be obtained from the secretary of the society, Charles Carroll Brown, 702 Wulsin Building, Indianapolis, Ind.



WORKERS IN THE FIELD

Houston, Texas, Has Co-operative Lighting Franchise

The Editor of MUNICIPAL ENGINEERING:

Sir—For years the Houston Lighting & Power Company, without competition, had been showing net earnings of about 20 per cent. on the successive yearly valuations. Total dividends of the company on the stock from 1906 to 1914 were $1,553,125.00, and the net value of the properties of the company on the last year was only $1,524,841.79. The service was fair to the consumer but the rates were admitted to be rather high.

In February, 1914, Mayor Ben Campbell, of the city of Houston (which is operated under the commission form of government), inaugurated the first step of an investigation into the affairs of the Houston Lighting & Power Company, with the avowed purpose of either bringing about a substantial and equitable reduction in the price of electric light and power for the people of Houston or building a municipal lighting plant for Houston. To this end, the city of Houston secured the services of Mr. Lamar Lyndon, consulting engineer, of New York City, who, assisted by a corps of experts, made a minute examination of both the physical and book properties of the lighting company, operating statistics, earnings and disbursements and the general output and equipment of the company. His comprehensive report, together with his recommendations for making the new rates, was submitted to the city of Houston. A copy was furnished the lighting company, who immediately employed an expert to go over the report and submit a counter-report. The difference in the valuation put on the properties of the company by the city's expert and the company's expert was aproximately $1,000,000 due largely to the fact that the company had taken no account of depreciation during the life of their plant. A fund was provided for depreciation by the company at one time, but subsequently passed to dividends.

The result of these reports was: (1) To present a financial history of the company; (2) To determine the proper valuation of the properties of the company, which should be used as a basis to determine the income which the company should receive in order to make a reasonable profit on its investment; (3) To show what the company received from all classes of service up to January 1, 1914, in order to pay all costs, depreciations and 8 per cent. profit on the proper capital charges existing over the period of years considered; (4) To show the various rates for electrical service which should obtain in Houston under the conditions of load, load factor, distribution and investment as obtain with the present equipment of the company, and compare them with the actual rates, and (5) To recommend equitable, just and fair rates for the future.

Pending the settlement of the lighting question, the city of Houston passed an ordinance which stated that any adjustment made between the company and the city of Houston, must apply and date from and after April 1, 1914, consequently, the rates just named will mean a substantial cash discount or refund to the citizens of Houston dated back from April 1, 1914.

During the progress of the light controversy, Mayor Campbell investigated every contract held by the company for power or light with wholesale customers. This inquiry resulted in ascertaining that thirty-two wholesale customers in the city of Houston were under "special contracts" with the company, by which contracts they received light and power at prices from 5 to 2½ cents per Kw. hr., while the other citizens were paying prices from 13 to 7 cents per Kw. hr. The company explained that they were "compelled" to make special contracts to prevent the wholesale customers from constructing their private generating plants.

After eight months' investigation, the following comprise the new light rates,

which will save the citizens of Houston, Tex., approximately $200,000 each year, and explain their workings:

Lighting Rates: Nine cents primary per Kw. hr., and 5 cents per Kw. hr. for secondary consumption. All charges for lighting consumed for residential purposes each month shall be divided on the bill into primary and secondary charges, and the methods of determining primary and secondary energy shall be as follows: The unit for measuring the amount of energy to be charged for on primary basis shall be one-fortieth of the number of socket openings to each residence served, and the number of kilowatt hours charged for primary service shall be 30 times the unit thus attained; or, in other words, the primary basis shall be, as to each residence, the first 30 hours use in any monthly period of 50 per cent. of the connected load, the connected load being taken at 50 watts per socket opening in the premises served. All energy used by each residence in one month in excess of the energy thus charged as primary, shall be charged to the customer as secondary consumption at secondary rate. This formula shall be printed on the back of every bill rendered Houston customers.

Commercial Rates: To be the same as above, except as follows: The first 40 hours' use in any monthly period of the connected load of 50 watts per permanent socket opening in the premises served.

Power Rates: There shall be charged not more than the following rates: Five cents per Kw. hr. for primary and 2½ cents per Kw. hr. for secondary consumption. All energy for power service shall be divided into a primary and a secondary charge, and the energy that shall be paid for on primary rate shall be the number of kilowatt hours consumed which would be equal to 17 times the rated horsepower of the motors connected in the business served, and all energy consumed each month in excess of the energy charged as primary, shall be charged for at the secondary rate as secondary consumption. This formula shall also be printed on the back of every bill, for the benefit of the cus. tomer. In addition to the rates for motor services, the company is permitted to charge 25 cents per month per horsepower of connected load, based on the motor rating. Where extra motors are installed for fire protection only, the company is permitted to charge 25 cents per horsepower per month, based on the motor rating; and where they are installed in "readiness to serve" in emergency cases, such as breakdowns, etc., the company is permitted to charge 50 cents per horsepower per month, based on the motor rating.

Arc Lights: All series circuit outdoor city arc lights shall be installed complete for $57.50 connected with an overhead circuit; and $60 each when connected with underground circuit, per year, payable in monthly installments. These arc lights shall utilize not less than 6.6 amperes at approximately 80 volts per lamp. Where alternating arc lamps are used, the actual energy consumption in any lamp circuit must not be less than 425 watts per lamp, while in the case of magnetite lamps, the energy consumption must not be less than 350 watts per lamp. The company is required to use German "Electra" carbons or other carbons of equal merit in all alternating arc lights, and cored carbon in all lamps, and the light shall at all times be uniform and free from flickering, hissing or pumping.

Cooking Rates: Minimum bill, 50 cents per month. Energy for cooking to be metered separately at the rates of 5 cents for primary and 2½ cents for secondary. The unit of measuring the primary current shall be determined by the first six Kw. hr. of consumption each month for cooking and the balance of the energy consumed as secondary consumption.

Electric Fans: Where the entire load on the circuit is made up of fans, this load shall be rated as a motor load and shall take the same rates as for power service.

Representation on Directorate: The mayor of the city of Houston, under the light adjustment, was given the power to name two members of the board of directors of the Houston Lighting & Power Company, which members will own no stock, but will represent the city's interests on said directorate.

The Houston Lighting & Power Company is owned by the American Cities Company which, in turn, is controlled by the United Gas & Electric Company of New York, according to the findings of the investigators. That a settlement of so much importance also gave the city of Houston the right to participate equally in all earnings of the company above $160,000, or 8 per cent. on their valuation, at the end of the first year, was one feature which pleased the people of Houston. The city claims that the new rates will permit the company to make more than 8 per cent. on their property valuation. In a year the city of Houston will be entitled to one-half of all earnings over $160,000, and will still have the privilege of reducing the light rates to the people so that there will not be an excess in the earnings over 8 per cent. on the amount involved.

Under the rates just made Houston has the lowest lighting and power rates in the South furnished by a private corporation.

PAUL H. SHELDON,
Houston, Tex.

Following are given the old and new rates in tabular form, so that comparison can be made readily:

OLD RATES

COMMERCIAL

Primary,	per Kw. hr.	$0.13
Secondary,	per Kw. hr.	.07

Subject to 5 per cent. discount.

POWER

Primary,	per Kw. hr.	$0.06
Secondary,	per Kw. hr.	.05

ARC LIGHTS

City,	per year.	$70.00
Commercial	per year.	90.00

NEW RATES

COMMERCIAL

Primary,	per Kw. hr.	$0.09
Secondary,	per Kw. hr.	.05

Subject to 10 per cent. discount.

POWER

Primary,	per Kw. hr.	$0.05
Secondary,	per Kw. hr.	.02½

ARC LIGHTS

City, for Underground connections.	$60.00
City, for Overhead services.	57.50

Commercial—The same as above.

Sewer Tunnel Construction in Alton, Ill.

The Editor of MUNICIPAL ENGINEERING:

Sir—A sanitary sewer district of 13½ miles of main sewer consisting of 8, 10, 12, 15 and 16-inch pipe and 4½ miles of 6-inch lateral connections built by Chas. E. VanWormer, of Springfield, Ill., contractor, has been completed and accepted by the Board of Local Improvements of Alton, Ill., and is now in successful operation.

In the construction of the system it was necessary to construct an outlet sewer two miles in length to the Mississippi River about 1,000 feet of which is in tunnel thru a hill 39 feet high, in which 12-inch cast iron pipe was laid at proper grade. The contractor in the construction of this tunnel deemed it a small job in itself and thought it not advisable to provide an expensive equipment for the construction of same. Such difficulties as arose during the construction had to be met with a rough equipment on hand.

The stakes were set every 50 feet on the center line and every 200 feet shafts were sunk to the proper grade. These shafts were made 4 by 8 feet and properly braced with oak timbers. The 8-foot side was parallel to the center line of the sewer. At each side of the shafts plumb-bobs were dropped and used to line up the tunnel driving.

Two shafts were worked at a time. Over each shaft was placed a swinging boom from which a wooden bucket was lowered and raised in the shaft with wire rope. Midway between the shafts an ordinary double-drum hoisting engine was placed. The wire rope from the buckets wound on these drums so that when one bucket was up the other bucket was down in the shaft. At the bottom of the shafts the heading was driven in both sides at the same time. The tunnel was made 6 feet high and 3 feet wide. The sides and top were sheated with 3-inch oak planking as the tunnel was driven. One man was at the heading, one man loaded the wheelbarrow and wheeled the muck to the shaft, where it was dumped into the buckets and raised to the surface and dumped. When a tunnel had been driven halfway to the next shaft, work from that end stopped, and the men went ahead to the next shaft. The heading men usually met very close to the center.

One difficulty experienced, was lack of ventilation. It was impossible to keep a light burning in the tunnel so that men could see or breathe after they had gone a few feet from the shaft. To overcome this an ordinary blower fan was secured and a 1½-h.p. gasoline engine was used to operate same. From the discharge end over the blower fan a 3-inch galvanized iron down-spouting was connected by means of tees, elbows and straight pipe down into the two shafts and thence each way into the headings. This fan furnished sufficient air so that all four headings could be worked continuously.

The booms above the shafts were also used for lowering the 12-inch cast-iron pipe. The pipes were lowered at the lower shaft and pulled ahead by cable tied to hoisting engine. When all the pipe had been lowered to extend from one shaft to the other and pipes were lined up and set to proper grade, spigot ends were driven home into the bell ends and yarned and calked with lead. The entire equipment was then moved to the next shaft, and the same process as above described was gone thru.

The entire 1,000 feet was driven in this way. Three shifts were steadily employed, each working 8 hours. The total cost of the improvement was $97,000.

The tunnel was driven and pipe laid in eight weeks. The work was carried on under the supervision of the writer as city engineer.

J. E. SCHWAAB,
City Engineer, Alton, Ill.

The Training of the City Manager

The more efficient the government, the more efficient the employe.

Mr. Bryce, of the American Commonwealth, says: "There is no denying that the government of cities is the one conspicuous failure of the United States."

This statement should not be too discouraging. For years we ourselves have recognized the fact that we have been improving the conditions steadily.

In 1876 New York appointed a commission to devise a plan for the government of cities in the State of New York, and they suggested the following as the causes of the failure of the old forms of municipal government:

1. Incompetent and unfaithful boards and officers.
2. The introduction of state and national politics into municipal affairs.
3. The assumption by the legislature of the direct control of local affairs.

Sometime ago we began to realize that the city was a business corporation rather than an integral part of the state. In 1882, Brooklyn, New York, took a step toward concentrated power in connection with concentrated responsibility, by giving the mayor absolute appointive power without the confirmation of council of the principal executive heads of the departments.

Mr. Woodruff epigramatically states, "For policy we must select, for efficiency we must appoint."

This has been the difficult step to achieve: it means the breaking of the political hold on our political affairs, the loosening of the grasp of the professional politician, who stands for efficiency in his ward and precinct organization first, and efficiency in municipal affairs second. As Mr. Bryce so aptly states in criticising our municipal affairs, "There is a want of methods for fixing public responsibility on the governing persons and bodies."

We know from experience that the political appointee's first allegiance is to his political machine. This tradition has shackled general advance.

The city manager form of government is the application of business methods to the operation of a city.

The fundamental training of a city manager is the same as the training of any manager of large affairs.

He does not have to be an engineer.

In many American cities the engineering problems are the most important today.

Any good executive can be a good city manager.

Cities desiring city managers should elect the one whose previous training will best meet the requirements of every community.

If these statements are true, and we believe they are, how can city managers be best rtained?

A city manager should have at least a fair education, sufficient theory, but not too much to overbalance practicality.

He must be an executive.

He must know how to handle men.

He must be fair and just.

He must be firm but polite.

He must have the courage of his convictions.

Any man with these qualifications can be a city manager. Such a can can select subordinates and advisors to aid him in carrying out the functions of those departments with which he is not familiar in detail.

He as an executive must get efficiency from all his departments by organization.

This is what we have always attempted to accomplish in our old forms of municipal government.

We found, however, that we could not select them thru the ballot.

This is where the straight commission form of government is failing, as it attempts to select trained men for principal functions thru the ballot, and also attempts to combine the legislative and the administrative functions.

There is in communities a feeling against the employment of out-of-town men for city managers. This is usually the harping of the old faithful in the ranks of the political parties.

A perfect organization can usually be attained more quickly by selecting a manager from out of town, as he is not hampered by the local traditions.

I cannot lay too much stress on the importance of publicity. Under the old forms of government only such publicity was given as would best meet the ends of the particular parties in power.

The new forms of government must give to the citizens constructive publicity.

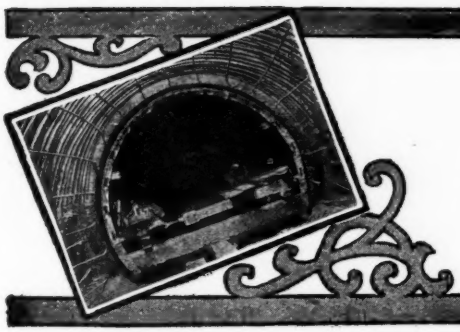
We must educate the people to the advantages which they are receiving from the new form of efficient government.

Under the old order of things, as soon as one party was elected into power, the public were immediately put thru a course of education as to why that party should be out of power.

The result has been that the notion is inbred for change.

As a result, every two years the citizenship becomes restless for change. This can only be overcome by education and constructive publicity.

H. M. WAITE,
City Manager, Dayton, O.



SANITATION

Pollution of the Des Plaines River by Chicago Suburbs

The Des Plaines river rises in Wisconsin a few miles north of the Illinois line and runs south parallel to the shore of Lake Michigan until it reaches the present location of the Chicago drainage canal when it turns toward the southwest and makes its way to the Illinois river. Above the drainage canal it receives very little drainage from the city of Chicago proper, but its watershed contained a population of 71,960 in 1910, of which one-third were inside the sanitary district. At present there are some eighteen or twenty sewers and drains of 15 to 18 inches diameter discharging into the stream and there is one sewage disposal plant in operation, that at LaGrange, a population of over 47,000 being served at least in part by these sewers. The central villages contain about 25,000 of this population, which would require a flow, for proper dilution of the sewage, of 85 cubic feet per second. This flow is attained on the average not much more than half the time and there may be 225 days in the year when the flow in this part of the Des Plaines river is less than 10 cubic feet a second. It is evident, therefore, that complaints of nuisance are well founded and will become more serious as the population increases.

A report by the engineers of the sanitary district shows that the flow of the river cannot be equalized to produce a satisfactory low water flow by means of reservoirs or otherwise and that pumping water from Lake Michigan for dilution would be too expensive.

Outfall sewers and sewage treatment plants are compared for each village and for the villages together and various plans are presented, contrasted and compared.

The problem is further complicated by the suit to prevent the use of more Lake Michigan water for diluting Chicago sewage in the drainage canal. If this suit is successful, all the sewage of the territory on the Des Plaines above the canal must be purified before it is discharged into the river. If it is not, at least part of the sewage can be brought down by intercepting sewers and discharged into the canal without treatment.

Meantime the report recommends the preparation of such plans as may be prepared in advance of the decision so that there will be no loss of time in beginning construction when the field is clear. The population of the area is requested to bear the ills it has with the best grace it can until the decision is made, as otherwise its expenditures may be on works which must afterwards be abandoned or changed at great unnecessary cost.

Sewer Explosion at East Boston Pumping Station

Associate Justice Charles J. Brown, of the East Boston District Court, has filed his report on the inquest on the explosion June 1 last at the pumping station of the Metropolitan Sewerage plant in East Boston with the clerk of the Superior Criminal Court.

The explosion resulted in the death of James Grourk, Philip Healey, Martin Devereaux, Cornelius Sullivan, Thomas M. Butler and Elmer Gifford, while others were injured. The inquest was conducted during July, and postponed until October, pending an investigation of conditions by experts.

Judge Brown's report on the death of James Grourk, which is similar to that of the others, is as follows:

"James Grourk died in consequence of burns and injuries received by him caused by an explosion of gasoline in the Metropolitan sewer at the pumping station located at Chelsea Creek, in East Boston. This pumping station is one of the largest in the Metropolitan system, and pumps the sewage which comes from all the cities and towns of the north Metropolitan line.

"On the day of the accident the deceased, with other employes, was working in what is called the screen room at said station, installing a duplicate set of screens. There was a large amount of gasoline in the sewer, which vaporized and was ignited from some source unknown, causing a terrific explosion, which demolished the building and injured several people, of whom six died.

"This branch of the Metropolitan sewer covers a distance of 62½ miles, and has the sewage of many cities and towns flowing into it. There is a large number of garages in these cities and towns, which have connections with this sewer, as well as several de-greasing plants, laundries and other manufacturing establishments, which are constantly discharging gasoline, naphtha and benzine into this sewer, making it extremely dangerous and a menace to the public safety.

"I find there is a general laxity on the part of the local authorities in preventing this, and I recommend that the Metropolitan Water and Sewerage Board or the district police take the necessary action to remedy this evil.

"A most thoro investigation and examination by city and state engineers of the sewer and pumping station at different periods, as well as analyses made by city and state chemists of the effluent and air, proved conclusively that gasoline and other explosive substances are continually flowing thru the sewer, and I further recommend that all garages and other establishments using gasoline, naphtha and benzine in the several cities and towns which have connection into this sewer be compelled to instal separating traps, as is required under the regulations of the city of Boston.

"If this is done it will prevent almost entirely any gasoline, naphtha or other explosive substance getting into the sewer in the future."

The Metropolitan system that empties at East Boston is 62 miles long, and is the outlet for Arlington, Belmont, Charlestown, Cambridge, Chelsea, East Boston, Everett, Malden, Medford, Revere, Somerville, Stoneham, Wakefield, Winchester and Woburn.

Street Cleaning in New York

The department of street cleaning of New York city had an appropriation in 1913 of $8,403,205. This was to pay the expense of cleaning streets, removing ashes, rubbish, street sweepings and garbage to the dumping places, the removal of snow and ice and the sanding of the streets.

The city is divided into districts and each district into sections. In a paper by Frederick L. Stearns before the municipal engineers of the city of New York, the ninth district is taken as typical. This district is bounded by 58th and 89th streets, Central Park and the Hudson river, in charge of a district superintendent with a conveyance, and has four sections, each with section foreman with bicycle and an assistant foreman.

The district has 624,864 square yards of pavement and the daily average cost of cleaning the district is $238.52. The average number of sweepers is 64, each cleaning 9,654 square yards. The cost of hand sweeping is 38 cents per 1,000 square yards; $3.07 per cubic yard of sweepings. The average number of drivers used in the district is 60.

Hand Sweeping. The street sweeper, with his outfit, consisting of a can carrier, push cart, push broom, push scraper, etc., is assigned to a route. He goes over his route in the morning, picking up the litter, then goes over same, sweeping it. He puts the sweepings in a can on his can-carrier. When the can is full, he places it on the sidewalk near the curb. The cart driver collects these sweepings and takes them to the dump.

During the winter months, the sweeper wears a coat and cap, and thru the summer months a shirt with D. S. C. on it and a white helmet.

The sweepers meet at their respective section stations for roll call at 7:45 a. m. and after 4 p. m. of each week day. In these section stations each sweeper has a locker for his clothes, etc., and there are storage rooms for the utensils. Previous to Col. Waring's time the sweepers met on the street corners and stored their brooms and shovels in such basements as they could get permission from the owner. The sweepers receive $780 a year and 25 cents an hour for Sunday work. There are 2,570 regular sweepers and 349 extra sweepers.

In the whole city the area of pavement to be cleaned is about 26,454,500 square yards. The average area for a sweeper to clean is 8,895 square yards.

Sweeping Machines. Revolving brooms sweep the street dirt into the gutter. By hand labor it is piled and shoveled into carts or put into cans by the street sweepers on the route. Nearly all of the 148 sweeping machines now in use were built by contract from plans and specifications prepared by Mr. Stearns.

The machines average in cost $185 each. New parts are kept in stock and the repairs are made by the department force.

The broom itself is made of thin hickory strips and does not revolve unless a clutch is thrown by the driver connecting the broom axle with the traction

wheels. The sweeping machines are used where the sweeping is heaviest and are a great help to the hand-sweeping force. These machines cannot be used unless the street is first sprinkled to lay the dust. As the use of water is prohibited during the winter months, the machaines cannot be used during this part of the year. It costs 52 cents per 1,000 square yards to clean strets by this method.

The Merritt sweeping machine has three revolving brooms, one on each side of the machine, set at an angle so as to sweep the street dirt under the machine, and another set straight across at the rear which sweeps this dirt on to a conveyor. This dirt is conveyed to the top of the machine and discharged into cans on a platform in the front of the machine. These cans when full are placed upon the sidewalk near the curb and replaced by empty cans. The driver on the route empties these cans as he comes along making other collections. The city paid 41 cents per 1,000 square yards for the work done by this machine.

The Emerson vacuum cleaner has a broom that does the sweeping, a conveyor that carries the street dirt to a receptacle and a revolving fan that produces a current of air that carries the dust thru screens like the pneumatic carpet cleaner. The city paid 43 cents per 1,000 square yards for the work done by this machine.

Flushing. The most thoro method of cleaning streets is by the use of water in dry weather. The water washes the dust from the street surface and in moist weather it washes the slime away.

There are several methods in use for this purpose, the most common of which is washing the street with a hose attached to a hydrant. It is, however, expensive, wasteful of water and obstructs traffic. In a gang there are several sweepers with push brooms that sweep up and put in their can any material not washed into sewers. Hose flushing in the summer days is very welcome in the tenement district.

The cost of hose flushing per 1,000 square yards is 65 cents and requires an average of 1,969 gallons of water.

Another method of cleaning the street is by the use of flushing machines. There are two styles of such machines in use. In one there is an air and water tight tank. As the water enters the tank from the hydrant, it compresses the air in the tank, which is generally at about 5-lb. pressure before it is charged with water, until it is at the same pressure as the water in the hydrant. This compressed air forces the water on to the streets thru properly arranged nozzles. This arrangement is quite slow. Officials of the city came to watch these machines in operation and became impatient because most of the time the machine was either going to, coming from the hydrant or at the hydrant getting its charge of water. It has been found to be very saving in the quantity of water used and by going over the surface of the street a sufficient number of times, thoroly cleans any kind of pavement. Its slowness of work is, however, offset by its cheapness of operation. The pressure that forces the water onto the street is obtained from the pressure of the water supply, and any driver of ordinary intelligence can run the machine. It costs 39 cents to clean 1,000 square yards and uses 401 gallons of water. The city has tried several experimental machines of this type but at present owns only one.

Mr. Stearns designed a machine that had an air tank in one end of the large tank. There was a gasoline motor and air compressor on the front of the wagon. The air compressor was small and ran all the time, filling the air tank with compressed air. This compressed air was to be used as the pressure obtained from this hydrant became too low for effective work, thus keeping up the pressure until it was nearly all out of the tank. The valve to the air tank was then closed and the air compressor continued running all the time the machine was driving to the hydrant, charging, returning to the street to be flushed and until it was time to open the valve to connect the two cells of the tank. Air compressors are very heavy and this arrangement made a lighter machine and made use of all the pressure that could be obtained from the hydrant pressure and only acted as an auxiliary pressure supply.

Another machine was designed to work independent of the hydrant pressure. The tank was completely filled at the hydrant. The air compressor was large enough to pump all the air that was necessary to force the water to the street, as this required pressure. It was the most powerful and rapid apparatus that has ever been tried for street cleaning. In working for hours it only required three and one-half minutes to a block; this included all the time required for charging with water and traveling to and from the hydrant. This is some contrast to the previous machines that required 22½ minutes to a block. These blocks were running north and south on Madison avenue.

The other style consists of a water tank, gasoline engine, and a water pump. The tank is completely filled with water like an ordinary sprinkling wagon and the rotary pump forces the water onto the pavement at any desired pressure.

It is easier to pump water than air to do the same amount of work, and the machinery is much lighter.

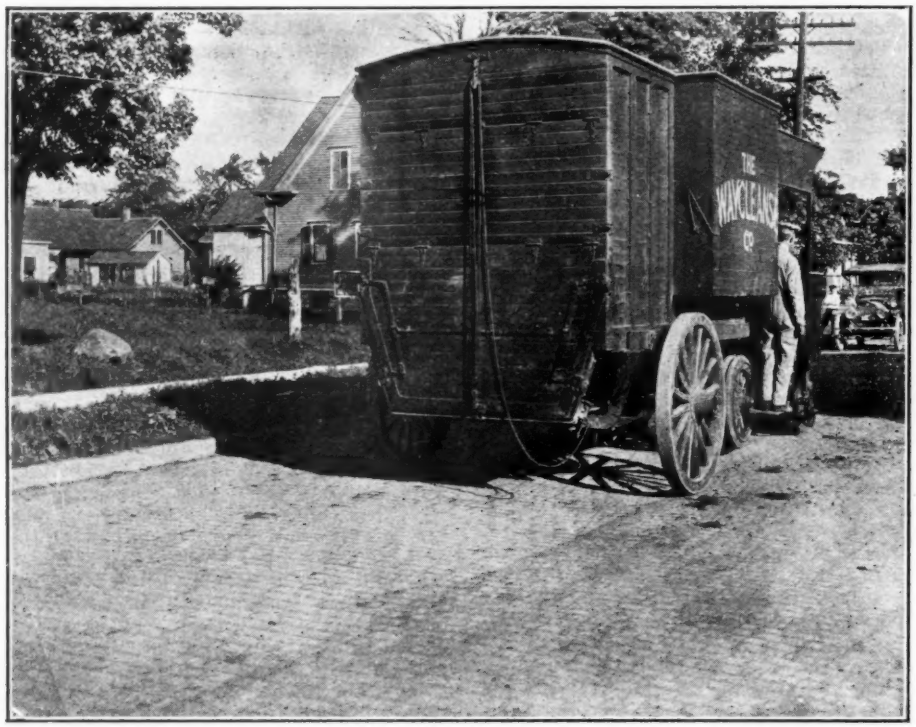
This machine works faster than the hydrant pressure machine, but a higher priced operator must be employed to run the engine. The cost of repairs are also higher and the cost of the gasoline must be added to the costs of operation. It is not dependent on the pressure of the water supply and is very satisfactory. Four of these machines are owned by the city.

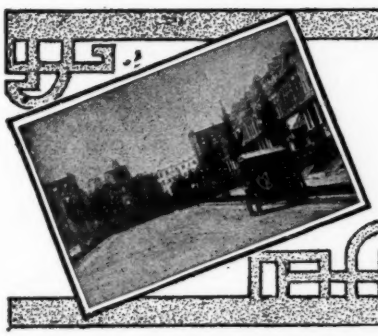
Another method of washing the street is by the use of a squeegee machine. There is on this machine a water tank that sprinkles the pavement under the front wheels and a revolving rubber squeegee at the rear of the wagon. This is also quite a satisfactory machine for asphalt pavement that is in good condition. It is also very economical in the use of water and the revolving rubber squeegees the mud, dust and slime to the gutter, where it is picked up by the street sweepers. The city owns thirteen of these machines.

Experiments have been made with river water for flushing purposes, but there is a strong sentiment against its use because of its pollution with sewage.

By instruction of the former Commissioner Woodbury, Mr. Stearns exposed gelatine plates in different parts of the city and collected dust, particles and germs from the air before and after washing the street. It was found that the washing greatly reduced the germs. In one experiment the reduction was from 239 to 85 colonies. These plates were placed in an incubator at the Cornell Medical School,, and the germs allowed to grow until in the best conditions for photographing and examining under the microscope.

SHOWING *work done by a pneumatic broom sweeping machine on brick pavement.*





ROADS AND PAVEMENTS

Road Economics

The following selections have been made from the excellent paper before the Atlanta Road Congress by J. E. Pennybacker, chief of road economics of the U. S. Office of Public Roads:

1. All who share in the benefits of road improvement should share proportionately in the burdens.

The country road is no longer a mere local utility. Legislation should, therefore, provide for city taxation in aid of country road improvement. Automobile owners should individually pay a material portion of the cost of our public roads.

2. The degree of improvement should be proportionate to the traffic important to the road improved.

Too often have we seen costly improvements distributed according to the dictates of a few influential citizens or according to some arbitrary arrangement of political units or for sentimental reasons, or thru a cheerful, haphazard indifference. It is now generally believed that four-fifths of the traffic of this country is carried on one-fifth of the road mileage. It should be manifest that the most heavily traveled roads should first receive attention and should be improved in the most substantial manner. It is entirely feasible to make an expert study of a country road system and indicate graphically the traffic areas for each important road, so as to establish with reasonable exactness the amount of outlay which the traffic would justify.

3. The rate of payment or the rate of accumulation of the sinking fund on any public debt contracted for road improvement.

One faction either opposes debt in any degree, or contends for an indebtedness of such short term as to make it almost a cash transaction, and asserts that the road is entirely destroyed long before the debt becomes due. Another extreme faction contends for long-term indebtedness, on the theory that as posterity will reap the benefits it should bear the burdens, and that a road well maintained never wears out. As a matter of fact, location, if intelligently made, should be permanent; likewise all reduction of grades. The drainage features, if honestly and efficiently constructed, should be reasonably permanent. The road, except under extraordinary conditions, should, therefore, be considered reasonably permanent as to these features. As a general rule, the foundation of a road should not require renewal if the road is subjected to adequate and continuous maintenance. Avoiding any detailed consideration of the exact proportion of the total cost of a road represented by these features, I should say that in general the permanent features would average at least 50 per cent. of the total cost. So that, if the other 50 per cent. must be figured as perishable and subject to renewal, the debt should not cover a period longer than twice the length of this perishable portion.

4. Road building and maintenance comprise work requiring special qualifications on the part of those who direct it.

If the laws of the state would require that all persons selected to have immediate direction of road or bridge construction and maintenance possess practical knowledge and experience, and that this fitness be tested by some sort of competitive examination to be prescribed by a state highway department, acting either directly or thru a civil service commission, the net result would undoubtedly be the saving of many millions of dollars of road revenue and a wonderfully increased efficiency in our road system.

5. Responsibilities should be definite as to persons.

This proposition is aimed at the elimination of our present complex and cumbersome system of road management. If all of this antiquated organization could be swept aside and in its stead one or a few officials endowed with authority and charged with responsibility in each county, the beneficial effects could not fail to be most marked.

6. Continuous employment is more conducive to efficient service than intermittent and temporary employment.

It is so self-evident that a minor defect in a road can be repaired at its inception with little effort, and that if allowed to go on it may require the entire reconstruction of the road surface, that it seems scarcely necessary to urge the soundness of this proposition.

7. The specialists who direct road work should be appointed instead of elected, and they should hold office during efficiency instead of for a fixed term.

The seventh proposition is designed to attract to the work men who look upon road-building as a life profession or occupation. If the right man is in the right place, it is absurd to limit him to a fixed term, for his position is not a reward. The county is purchasing his services and is supposed to get value received, and it should continue to purchase so long as he delivers the goods.

8. No road is wholly permanent but requires continuous upkeep, for which financial and supervisory provisions must be made.

A house is not permanent without repair, a railroad track is not permanent without repair, then why should public funds in a large amount be expended in road construction which, without adequate maintenance, may deteriorate to the extent of 50 per cent. in a few years?

9. Cash is a much more satisfactory form of tax than is labor.

If you provide an efficient highway engineer or county superintendent with a modest amount of cash and let him select competent,, efficient laborers, he can quadruple the effective results obtained by the same number of laborers under the old statute system.

10. All agencies at the disposal of the state, capable of use in works of public improvement, should be so used, rather than in such commercial production as would conflict with private enterprises.

The tenth proposition is directed partially toward the convict labor question, and is based upon the assumption that offenders against society owe a debt to society which should be paid in such form as will most benefit society, and the further assumption that honest labor should not be discriminated against thru the sale or disposal of products created by criminal labor. The practical application of this proposition would mean the employment of convicts in road-building, the preparation of road materials, or in other works of public improvement so far as practicable. This proposition is intended also to emphasize the necessity for correlation of the states' various agencies in the interest of road improvement. For example, a state geologist should be helpful in the selection and location of road materials, the laboratories of state universities should be useful in the testing of materials, the university staff should be helpful in the giving of theoretical instruction and in many cases in practical extension work, state bureaus of statistics and agriculture should be helpful in accumulating essential data for the road improvement work in the state, and state civil service commissions should be of very great use in the inauguration and conduct of the merit system in the filling of positions requiring technical or practical qualifications and experience.

Concrete For Paving

By G. W. Pickels, University of Illinois, Urbana, Ill., in Lincoln Courier.

Concrete was first used as a paving material in 1892 and from then till 1912 a total of 4,300,000 square yards was laid in the United States. In 1912 this type of pavement suddenly sprang into favor, and more concrete roads and pavements were constructed than had been constructed in the entire nineteen years preceding. Since then its use has steadily increased, and in 1913 over 8,000,000 square yards were laid, making a total of aproximately 18,500,000 square yards constructed up to January, 1914. For those who are not accustomed to thinking in square yards I will say that 18,500,000 square yards will pave 1,165 miles of 27-foot roadway. This yardage is distributed thru forty-two states, so it cannot be said that the use of concrete is local. It has been used principally in California, Illinois, Maryland, Michigan, Missouri, New York, Ohio, Washington, and Wisconsin.

The three principal types of concrete pavements are (1) the one-course, (2) the two-course, and (3) the bituminous top. Other types which have been used to a lesser extent are Hassam, Blome, Dolarway, etc.

The one-course concrete pavement as its name implies, is laid in one operation. The thickness depends upon the character of the subgrade, the drainage, the traffic, the width of pavement, etc., and varies from 6 to 10 inches. There is probably no other structure composed of concrete that requires as dense and as hard a concrete as does a concrete pavement. To secure this result care must be taken in selecting the sand and stone aggregate, and tests must be made both before and during construction to ascertain the proportions of cement, sand, and stone that must be used to obtain the

FINISHING SURFACE *of Concrete Pavement with wooden floats operated from traveling bridge spanning the pavement.*

densest and strongest concrete. A concrete pavement constructed on the assumption that concrete is concrete and that no more care is necessary in its construction than is required in a concrete sidewalk for example, is almost certain to be a failure. According to the best practice "the fine aggregate should consist of sand, crushed stone, or gravel screenings, graded from fine to coarse and passing when dry a screen of ¼-inch mesh. The coarse aggregate should consist of clean, hard, and durable gravel or crushed stone graded in size, all of which will pass a 1¼-inch screen and be retained on a ¼-inch screen.

The mixing and the placing of the concrete are as important as the selection and proportioning of the materials. The materials must be thoroly and uniformly mixed and especial care must be taken to see that they stay uniformly mixed and that the stone and mortar are not segregated after the concrete comes from the mixer. An uneven distribution of the material will take place if the mixture is too wet. One of the most common defects that is noticed in the surface of concrete pavements is the non-uniformity of the mixture, which results in a rough and uneven surface.

Longitudinal expansion joints are placed along each curb, and transverse joints are usually placed from 25 to 50 feet apart. The transverse joints should be protected from excessive abrasion and spalling by two strips of metal, 3 inches wide and 3/16 of an inch thick, having a high abrasion resistance, between which is placed the joint filler, consisting of a prepared felt about ¼-inch thickness and of a width equal to the depth of the pavement.

The concrete is brought to a uniform surface by means of a template resting on the curbs. It is then finished with a wooden float from a bridge spanning the pavement. To prevent the concrete from drying out too rapidly it should be covered with canvas until it has set, and then covered with sand or earth to a depth of about 2 inches, after which it is kept sprinkled for at least two weeks. If possible the pavement should be closed to traffic for a month after it is completed.

Pavements over 20 feet in width are generally reinforced with a triangular-meshed woven wire fabric, placed from 2 to 3 inches below the surface. The purpose of this reinforcement is "to distribute the effect of expansion and contraction due to temperature and the moisture content of the concrete."

The two-course pavement differs from the one-course in that it is not of the same composition for the entire depth and that it is laid in two operations. The first course is called the foundation course or base and is similar to the concrete base used for brick, asphalt, and wood-block pavements. It is generally about two-thirds of the thickness of the entire pavement and is composed of a much leaner concrete than is used in the one-course construction. The second or wearing course is usually composed of two parts of the fine aggregate, such as is used in the one-course pavement, and three parts of clean, hard, and durable crushed rock or gravel passing a ½-inch screen and retained on a ¼-inch screen. This course should be as dense and strong as possible to make it,

and should be laid before the bottom course has set. The function of the top course is to resist crushing and abrasion, and to do this it must be composed of a mass of hard stone firmly held together by a cement mortar.

The failure of concrete pavements of the above type to resist abrasion due to impact has led to the development of the bituminous top concrete pavement, which is nothing more than a pavement of the first or second type—generally of the first—with a thin covering of some bituminous substance which acts as a cushion and to some extent absorbs the shocks of travel. The difficulty that has been experienced with this type is in getting the bituminous covering to stick to the concrete, and because of this its use has been discontinued in some localities.

Approximately 20 per cent of the concrete pavements constructed to date are of the two-course type, and 80 per cent. are of the one-course type. Of the 80 per cent. of the one-course construction about one-half has been covered with a bituminous top.

There are five important factors governing the success of a concrete pavement: (1) Good material, (2) proper proportioning, (3) mixing, (4) placing, and (5) curing. Much stress is usually laid upon the first two items and not enough upon the last three. In fact, a pavement constructed of average materials, proportioned according to some standard ratio, but not tested for density and properly mixed, placed and cured, will usually give better satisfaction than one in which the materials are excellent in quality and correctly proportioned but carelessly mixed, placed and cured.

Concrete pavements are affected very little by rubber-tired vehicles even of the heavier class, but the impact and abrasion of horses' hoofs and of steel-tired vehicles causes considerable wear. If the pavement has been constructed properly so that the surface wears uniformly, no great harm is done; but if improperly constructed, the surface will become rough and uneven and full of depressions.

There can be no question but that the concrete pavement is a valuable type and that its use is certain to increase rapidly. However, judging by our present knowledge and experience, concrete pavements are suitable on streets of moderate travel only. Streets carrying motor traffic or light horse-drawn traffic that in the past have been paved with brick will in all probability in the future be paved with concrete. In comparing concrete with brick, asphalt, wood block, etc., it must be remembered that it is consideraly cheaper, being approximately 25 per cent. cheaper than brick, which is its nearest rival.

FINISHED CONCRETE ROAD *surface in Wayne County, Michigan; photographed by Universal Portland Cement Co.*

Concrete Paving Design

From an article by W. D. P. Warren in Engineering and Contracting.

The purpose of this article is to call attention to the great necessity for the design of concrete pavements.

Engineers have written numerous articles during the past few years concerning concrete pavements, laying stress on the importance of workmanship and materials, and in their endeavor to secure the best results by better workmanship and materials, they have almost ignored the more important item of design. Concrete is subject to certain laws and its behavior has often been demonstrated, both in bridge and building construction.

What are these stresses which cause defects in concrete pavements? Where are they applied? How great are they?

How may they be overcome? These questions may be briefly answered as follows:

Experience has demonstrated that expansion and contraction will cause transverse cracks in a pavement slab 6 inches thick, if the transverse joints are placed 50 feet apart, and that 25 or 30 feet is a safe distance to space them. Joints so spaced and protected by metal plates will free such a slab from any danger of transverse cracks due to contraction and expansion.

Other important stresses tending to produce cracks have been found to act vertically. Vertical motion is produced by the movement of the foundation upon absorbing moisture and again upon drying out. It is produced by the settlement of the sides of the roadbed, where they are less compact than the center. This vertical movement is sufficient to cause the slab to act as a beam.

Hundreds of miles of concrete sidewalk and concrete pavement blocks have cracked longitudinally. They all show failure along the center, or, in cases of extreme width, probably 10 feet out from the gutter line. This teaches but one thing, they were caused by forces acting vertically.

If a concrete sidewalk 4 feet long, 4 feet wide, and 4 inches thick does not crack longitudinally, and yet a block 4 feet long, 8 feet wide and 4 inches thick does crack longitudinally, what is the reason? If a thousand of such blocks crack longitudinally, what is the reason? It is not temperature, stress, contraction, expansion, unknown factor, dished or crowned sub-base, lack of reinforcement, but simply lack of strength in the slab to withstand the vertical movements of the foundation. In other words, for every width of slab, a definite thickness is required. This law is absolutely universal and every longitudinal crack in Wayne county, Michigan, Iowa, Illinois, or any other place, could have been prevented had the slabs been correctly designed.

We know the force of the vertical movements, for if they have caused uniform failures, and if failures have been prevented by a uniform reduction in width of slab to meet the thickness, we know all the necessary facts required to design correctly such a slab to withstand such vertical movements.

One reason why engineers have devoted so little time to concrete pavement design is that pavements have been a gradual growth from sidewalks and private driveways and few people have realized that a concrete slab for such purposes requires a design. Another reason is that the cement and steel people have designed either directly or indirectly many of the pavements and year after year they have proceeded with utter disregard of engineering principles.

The writer attended the National Conference on Concrete Roads, held last February in Chicago, and was in touch with many of the engineers there. It was observed that few came out with a frank admission of failure in design, and yet were more than anxious to learn a means of building concrete pavements without cracks, when it was intimated that such a thing was possible.

In MUNICIPAL ENGINEERING for July, 1913, The Morse-Warren Engineering Company, of Carlinville, Ill., discussed the mathematics of concrete pavement design at some length, and later a table was prepared showing the thickness required for certain widths. During the past year, the correctness of design outlined therein has been demonstrated to numerous engineers. While it is true that in rare instances a pavement may be built on a porous foundation which will not be subject to vertical movements, it is poor economy to build any concrete pavement which is not designed to meet general conditions.

There are a few principles of design which, if followed, will produce at an economical cost, a concrete pavement free from cracks. They may be briefly outlined as follows:

1. Transverse and longitudinal cracks are caused by stresses which are greater than the strength of the concrete.

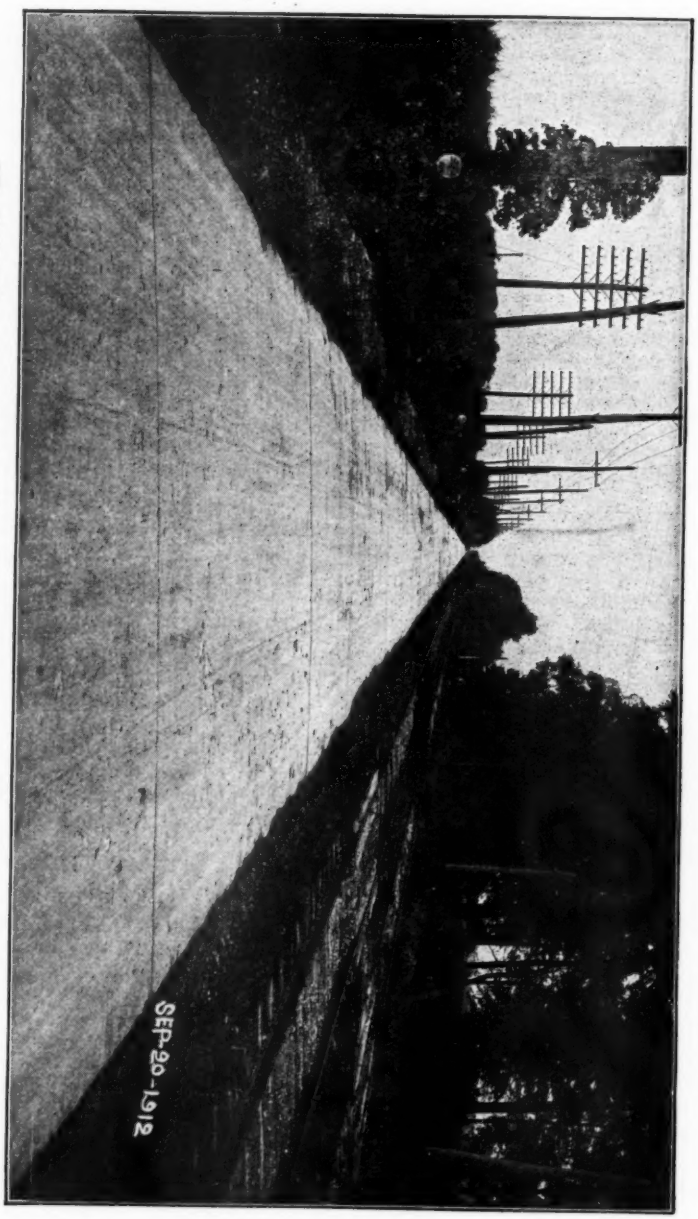
In other words, a slab of concrete, say 4 feet square and 6 inches thick, could withstand the forces of expansion and contraction and the vertical movements of the foundation, even tho they should raise it several inches. It could stand the shock of travel and the action of the elements; in fact, such a slab would be free from defects.

That the economical slab is much greater in size than one 4 feet square has been demonstrated, and that there is a definite economical size of slab will be more fully explained in this article.

2. Vertical movements in the foundation cannot be economically prevented by additional rolling of the sub-grade nor by drainage.

This principle will be more fully understood when it is known that some of the strongest efforts to reduce cracking by putting the sub-grade in a permanent, immovable, and absolutely stable condition, free from moisture, and free from any tendency toward future settlement, have failed entirely.

Take for instance the sub-grade at the edge of a pavement with a 6-inch tile laid 4 feet deep under that edge. In our section of the country, today, the entire sub-grade is dry. But suppose we have a season of rainy weather, with water



FINISHED CONCRETE PAVEMENT *with transverse joints protected by anchored plates on the system of the Trussed Concrete Steel Co.*

covering the ground in many places. The 6-inch tile will act promptly and proceed to carry off the water, but at the same time the earth at the sides of the pavement will have absorbed moisture, causing it to swell, and the earth under the center of the pavement absorbing less, will swell less, thereby causing unequal movement in the foundation and cracks in the pavement slab. This force acts in the opposite direction when the earth becomes drained at the sides more quickly than at the center. The writer has observed slabs of concrete absolutely supported by a longitudinal ridge of earth, with the edges of the slab extended out into space, so to speak, and acting as a cantilever.

3. Reinforcement is a deception, as geenrally recommended.

Several scientific articles have been published during the last year, calling attention to the fact that any sufficient amount of reinforcement to prevent cracks in concrete pavements is prohibitive in cost; also it has been shown that the per cent. of reinforcement now generally recommended and used is only about one-tenth that ordinarily required.

Many engineers have built reinforced pavements after having had failures in plain concrete pavement construction, and have not taken into consideration the fact that they are getting better results in their later work, not because of reinforcement, but because of better workmanship and material.

A representative of one of the large steel industries after having inspected many miles of pavements, recently informed the writer that he had at last given up the theory that concrete pavements were to be saved from cracking by the use of reinforcement.

The vertical forces tending to destroy a concrete pavement act both upward and downward and yet some material men have the boldness to advertise that a reinforcement placed 2 inches below the top of a pavement will absolutely prevent cracks. If necessary 2 inches below the top it is equally necessary 2 inches above the bottom but the point to be made here is that all such so-called reinforcement is not reinforcement at all; never was figured to be; and never can be anything but an extravagance and a deception.

4. For a given thickness of slab, with good workmanship and material, a definite width is required. The limit of width for a 6-inch slab, 1:1½:3 mix, is 10 to 12 feet, and everywhere you will find concrete pavements with longitudinal cracks where the width is any greater with that thickness.

5. It is economical to make a longitudinal joint in a pavement slab rather than increase the thickness where the width is increased.

If 6 inches is ample to give strength and durability sufficient for travel, it is poor economy to make the pavement any thicker simply to have a continuous beam or slab across the roadway.

Such a longitudinal joint should be protected by a metal plate now manufactured for that purpose. There is no patent on this plate.

6. A joint in a concrete pavement, properly protected and covered by a metal plate is not a weakness.

Engineers have in recent years thrown up their hands in horror at the idea of a joint down the center of a concrete pavement. The fact is that today thousands of taxpayers are throwing up their hands in "holy horror" at the joints in their pavements, joints not planned and not protected by metal plates, which are unsightly, damaging and irregular, and each year increasing the expense of maintenance. As suggested a year ago in one of our leading engineering magazines, longitudinal joints are not to be avoided; they are an absolute structural necessity.

7. A factor of safety should be allowed in design.

The methods of design herein outlined will produce a concrete pavement free from cracks, a pavement costing much less per mile than now recommended by engineers, and a pavement which contractors will with safety guarantee against cracking for a five-year period.

It is the belief of the writer that the design of concrete pavements and the proper protection of a longitudinal joint down the center of the pavement should now receive the attention of the more expert, and that present knowledge of construction should be classified, with the thought in mind that concrete pavement design be reduced to a science.

To those who see the possibilities of the future, and to those who believe that there are defects today in the design of concrete pavements, is submitted the proposition: To design or not to design.

Increase in Highway Construction in 1914

That remarkable progress has been made in the building of good roads thruout the United States during the past few years is proven by data recently obtained by the American Highway Association and soon to be published in the official Good Road Year Book for 1915. It has been found that more than 34,000 miles of surfaced roads have been constructed during 1913 and 1914 and that during the ten-year period from 1904 to

1914 more than 96,000 miles have been completed. That this progress has been really amazing may be understood from the fact that in 1904 there were only 153,000 miles of surfaced roads of all types in the United States. That the movement is attaining momentum as it goes is proven by the fact that while the average mileage construction per annum during the past ten years is 9,600 miles, the total completed for 1914 exceeded 18,000 miles. The report will show that something like 30,000 miles of highway have been completed with the aid of state funds, of which over $200,000,000 have been expended. The state aid movement began in 1892 and has therefore continued for twenty-two years. Only recently has it gotten well under way, as the results accomplished for 1913 and 1914 comprise a total of 10,000 miles of state aid highways completed, or in two years' time one-third of the entire mileage constructed with the aid of state funds has been completed.

Only six states now, out of a total of forty-eight, are without state highway departments and thirty states have granted actual money aid to the building of roads. The year book, which is the official reference publication for all good roads information, is a large cloth-bound volume issued early in each calendar year by the American Highway Association.

Simplified System of Town Highway Accounts

By Fred Buck, Assistant Deputy Commissioner, New York State Highway Department, before the Atlanta Road Congress.

The funds for town highway work in New York state are derived from two sources: First, a tax levied by local officials upon the several towns, this tax being supplemented by moneys paid by the state to the towns for the same purpose, which moneys are known as "State aid," the amount payable to each town being dependent upon the assessed valuation per mile of highways of the town and the amount raised by the town as the highway tax in each year. These moneys combined form what is known as the highway fund.

In the prosecution of the work the town superintendent of highways is the man in charge. He hires the men and teams, purchases materials, directs the work and acts as paymaster; the paying, however, being done by means of vouchers issued by himself as town superintendent, the vouchers being redeemed in cash by the supervisor (who is the chief fiscal officer of the town) and retained by him as a receipt for money paid until the close of the fiscal year, when, upon rendition of his annual report and its acceptance by the town board, these vouchers are filed with the town clerk and become a part of the permanent records of the town. These vouchers, which are furnished to all towns by the state highway department, consist of a printed form with the necessary blank space for the insertion of the date, the name of the payee, the dates on which service was rendered, the number of hours of service or quantity of material, as the case may be, and the road for which it was furnished. Each voucher is attached to a stub upon which are blank spaces similar to those of the voucher.

The supervisor is provided with a supervisor's account book, printed and ruled to receive an entry of each voucher paid, spaces being provided for data relative to the voucher corresponding to that in the body of the voucher itself. Pages are provided at regular intervals for a recapitulated statement of vouchers paid, the data upon these recapitulated pages being finally carried forward to a single page thereon condensed into a form of statement, which is the annual report of receipts and disbursements required of each town supervisor under the highway law. Blank forms are provided for such additional copies of this report as are required to be furnished to the county superintendent of highways, the state highway commission, and the state comptroller.

No other books or accounts are necessary for the town superintendent of highways or the supervisor in properly receiving, disbursing and accounting for the highway moneys of any town than those which have just been described.

With practically no exceptions the town officials are pleased with the form of accounting, and errors and mistakes have been reduced to a minimum so small as to be almost a negligible quantity.

Partial audits of the highway accounts of any town are made by a representative of the state highway department at any time during the year when for any reason it shall be deemed that the same is necessary or expedient. By doing this many errors are prevented which might otherwise occur and unwise or extravagant expenditures are prevented, or checked if begun.

Each year a complete audit of the highway accounts of each town in the state is also made, and it is found that the form of voucher and manner of accounting for the same provided for the supervisor greatly simplify and facilitate the work of the auditor.

It is pleasing to be able to state that, while the audits of the first year in which this system was put in operation showed a large amount of errors and discrepancies (due, mainly, to unfamiliarity with the system or to carelessness in making entries) the audits of the years since the first show a constantly decreasing number of inaccuracies. It is also pleasing to be able to state that extremely few instances of actual dishonesty have ever been uncovered and that in very nearly all cases in which reimbursement has been required the occasion for the same was due to ignorance or carelessness and not to actual dishonesty on the part of any town official.

Those who have been most closely associated with the work are also firm in the belief that the quality of the town highway work of the state as a whole and the very excellent results secured have been contributed to in no small degree by the simplified system of town highway accounting which has been used in connection with the work.

Road Maintenance in Minnesota

In a paper before the Atlanta road congress Geo. W. Cooley, state highway engineer of Minnesota, gives the following as the practice in that state:

The state of Minnesota has given special attention to the matter of maintenance and the present road laws make adequate provision for the care of all roads. Township and county roads constitute approximately 90 per cent. of the road mileage of the state, and of these roads, about 90 per cent. are earth roads. To care for the town and county roads, a one mill tax is levied on all property in the town, the proceeds of which constitutes the town dragging fund. This fund is expended under the direction of an overseer, appointed by the town board, for the purchase of drags, and in dragging all roads of the town, excepting state roads. This appears to be the most satisfactory method of caring for the earth roads under control of the local authorities, but there should be a provision in such cases, for general supervision of the work by the county highway engineer.

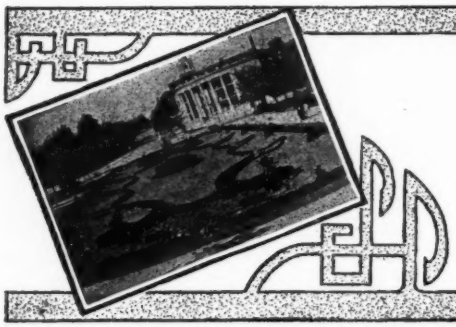
For the care of state roads in Minnesota, 20 per cent. of the state road funds, with a due proportion of county funds, are set aside and may not be used for any other purpose than maintenance of state roads. As the state roads include all types of construction, different systems of maintenance have been required in the different localities. In general, three systems have been established: The patrol system on macadam and well built gravel roads, and the maintenance section system, and road drag system on other roads, all being under the direct supervision of the district highway engineer.

Under the patrol system, one man is assigned a section of from 5 to 7 miles of road and works with hand tools. It has been found necessary to supplement this work with the occasional use of a team and in that manner it has proven satisfactory on macadam and gravel roads.

Under the maintenance section system, one man is given charge of a section of from 20 to 30 miles of road and is employed continuously with his team on the care of his section. He is given authority to employ additional help, both teams and men, and usually has two teams and four or five men at work. Contracts are also entered into by the section foreman with residents along the road, for the dragging of same after each rain, or when ordered to do so by him. The section crew takes care of all minor items of construction, such as placing culverts, etc., and we have found that the work when properly done, is really of a constructive nature. This system is without doubt the most effective, and is being adopted generally thruout the state.

The dragging system requires the employment of a superintendent of maintenance, who for convenience should be one of the engineer's assistants, whose duty is to contract or make arrangements for the dragging of all roads under his charge, and to see that the work is done at proper times. This system is suitable for slightly undulating prairie country, where most of the roads are of earth, and to get best results the superintendent should have at his disposal light graders to reshape the road bed at least at the beginning of each season.

On earth or gravel roads, no maintenance system is complete which does not contemplate the use of planers or similar devices, and a combination of work as outlined under the section system is recommended.



CIVIC BEAUTY

City Planning and A Topographical Map

From a Paper by Mayor Joseph W. Shirley, Topographical Survey Commissioner of Baltimore, Md., before the Engineers and Architects Club of Louisville, Kentucky.

It does seem odd that the separate elements embraced within city planning, such as buildings, railroads, municipal works of all character, are each studied and planned seriously and altogether scientifically. Yet, to the composite whole, there is the minimum of attention. In other words, the smaller things receive our most minute care and the largest thing that man has yet built, a city, is allowed to progress in the most haphazard and care-free way possible.

Out of the number of good recommendations which I read in the report of the Louisville City Improvement Commission, there are two which fall, especially, under the topic on which I am speaking. One is that you must have a good survey and map on which to base any plans for improvement, and afterwards you must endeavor to develop a sensible city plan. Your committee asks for $30,000 for the preparation of this map, hardly a sufficient sum. In Baltimore we made an excellent survey and a map on the scale of 200 feet to one inch with contour intervals of 5 feet, in square mile sections, 38 of them. It shows all essential details for the development of new areas as well as for the rearrangement of the older sections. A complete triangulation of the city based on the general method used by the U. S. Coast and Geodetic Survey was made; precise levels were established over the entire area, and now, after 20 years working on this map, and comparing it to those of other cities I know of no point of importance which was neglected, nor do I think any methods of less refinement could have been adopted to insure the same results.

City planning is construed by many of the unthinking as simply aesthetic plans with the sole idea of preparing for a civic center. Your committee's report grasps the true essence of city planning by considering the necessity for planning for the undeveloped sections of your city. This is something you can now do while you are, at the same time, giving study to conditions needing rectifying in your built up and congested sections. If you do not give proper attention to your growing sections you will very soon find that territory in as bad conditions as are the older portions of your city which were allowed to develop without care or attention. It is a relief to note that the report did not limit itself to the mere rearrangement of governmental and municipal buildings about a central neighborhood. I do not, however, mean to despise any proposal for the grouping of such buildings. There is an extremely worthy motive back of any such movement and one in which you will find you can arouse the greatest interest among the public generally. But to feel that city planning has this for its one and only object is a most serious mistake.

Just before our Baltimore map was made we had annexed a considerable area to the city, about 31.94 square miles. Previous to the time of annexation this territory had been studied according to the old fashioned lights regarding the system of proposed streets, and the streets were for the most part marked by granite monuments at the northeast corners. The lines conformed to the old checker board or gridiron ideas. Fortunately, however, we had a number of good routes of travel leading from the heart of the town to the outlying sections, and the old planners did adopt these routes in their plan of streets. It was realized, however, that the old county plan might not prove ideally satisfactory, and so a commission was appointed to study further this territory and to draw up an official plan. This was all done, and since that time, namely, in 1898, we have worked on the commission's plan of streets for the develop-

ment of our suburban sections. The old plan, viewed from the light of modern practices, was far from ideal and it has been amended and changed so often that its originators would now hardly know their work. I think, at one time, a great many of those having to do with the expansion of the street system in our larger cities felt that they could lay down a definite plan, adhere to it rigidly and, by some as yet unexplainable method, enforce the street plan development on all property owners. Our experience in Baltimore has been that this was indeed a fanciful dream. We have not done it, tho on the whole, I think we have succeeded very well in carrying out the more important elements of the plan. We rely principally on a law which states that the city cannot condemn and open a street nor accept the deed or dedication of any street the lines and grades of which do not conform to the established street plan. In other words, we can not absolutely prevent property owners from laying out their streets along non-conforming lines, but we can and do refuse to grade, pave, lay water mains and sewers or provide lighting in the beds of such streets as are incongruous to the plan, and this, in itself, has had a marked stimulus in limiting haphazard lay-outs.

But in by far the larger area under control of the Topographical Survey Commission the street plan is developed thru a compromise between the city and the property owners. This is, of course, not ideal and no doubt the future will give us more stringent means of developing the street system in conformity with the ideas of the city and not along the lines best suited to the individual property owners.

¶ WIDE, DIRECT THOROFARES *between sections of the city the main object of the Baltimore commission.*

Our main object, however, in the supervision of the street plan, has been to provide for wide, direct thorofares from one section to another and from all sections to the heart of the city. I think we have been fairly successful in this endeavor. We have felt that this is decidedly the most important factor in the development not only of the suburban area, but of the city as a whole. If we can enforce a good system of main arteries we feel that we have done a good work in providing the frame structure to which minor streets may be bound.

A subject of the greatest importance in city planning is transportation. Whatever the means of locomotion, steam, electricity, motor busses, or even air craft, we must have streets, and it seems only proper that the location, widths, extent and all governing features should be considered by men capable of making suggestions founded on proper and scientific study. In other words, let us, at least, try to develop our growing street system as well as we can.

At the same time, let us give study to the rearrangement of our congested and badly arranged internal development. These are the two main factors in city planning.

After the disastrous fire of 1904, Baltimore had an excellent opportunity to hew right and left along the lines affording better street facilities in the congested portion of the city. Those who have had anything whatever to do with any phase of city planning will know how extremely difficult it is to obtain even the smallest improvements. We did some things well and we also left undone some things which we should have done. On the whole, however, I think we can justly feel proud of the results.

The area destroyed in the Baltimore fire was 140 acres. After the improvements, including street widenings and extensions, were completed it was found that more than ten acres in excess of the old streets were used. In the heart of the most valuable property of the city this was quite an item. There were two other important improvements, new municipal docks and markets, which together took out nearly twenty-eight acres more of private property. The total cost of all the improvements in the burnt district was a little over seven and one-quarter millions of dollars. The benefits assessed in the nearby zone were about one and one-eighth millions of dollars, making a net cost to the city of a little over $6,100,000.

Before the fire there were 1,343 buildings which were assessed at a total of nearly thirteen millions of dollars. There are now less than eight hundred buildings, assessed at about twenty-five millions of dollars. So, it can be seen, that altho we wiped out about thirty-eight acres of valuable commercial property at a net cost of over six millions of dollars, we have at the same time practically doubled the value of the improvements now occupying this section. This, it will be understood, is the increased valuation on the buildings alone. As to the increased valuation on the land itself, it is hard to get any definite figures. This is due partly to the under valuation, and generally poor valuation, of the property before the fire. But conservative estimators now place the increase on the land at 50 per cent., at least. A simple

example in arithmetic will show that it will not be very long before the increase in taxes in the district will not only wipe our slate clean, but will give us a good revenue besides."

This is in contrast with the result in San Francisco outlined in the following extract from a paper on the water supply of the San Francisco-Oakland metropolitan district in the September proceedings of the American Society of Civil Engineers, by H. T. Cory, M. Am. Soc. C. E.

"The topography and natural features of San Francisco are such that it could have been made one of the most beautiful cities in the world. Unfortunately, like many other places, it grew 'topsy fashion,' and the layout is rectangular, quite regardless of the configuration of the land. There result grades as high as 22 per cent. The opportunity which the great fire of 1906 presented for redesigning the most important part of the city was not utilized. The city engineer's office recently stated that $26,000,000 was the cost of certain improvements, necessary under the circumstances, but which would have been entirely avoided had the city's planning been adjusted to the topography, as might have been done, and that this expenditure was but the beginning of a series which from time to time must be made."

¶LARGE PLANS *are the only ones which have any chance of success and are the only ones worth while.*

In any campaign for the development of your city along proper lines you will encounter the sometimes embarrassing query as to the net cost and the benefit, if any, from a purely monetary point of view.

Mr. Daniel H. Burnham, the famous designer of the World's Columbian Exposition at Chicago, once said:

"Make no little plans; they have no magic to stir men's blood and probably themselves will not be realized. Make big plans; aim high in hope and work, remembering that a noble, logical diagram once recorded will never die but long after we have gone will be a living thing, asserting itself with ever-growing insistency. Remember that our sons and grandsons are going to do things that will stagger us. Let your watchword be order and your beacon be beauty."

It is hard, however, to convince many citizens that the improvement which you may be considering falls within the category mentioned by Mr. Burnham, and you will often be required to give some kind of estimate of the cost. In a great many cases in city planning this is well nigh impossible and you must have recourse to similar undertakings in other cities. Good city planning has not been applied for a very long time to many American cities and you may be often hard put to it to find a proper analogy. It is, however, often surprising, when the attempt is made to seek such information, to discover excellent suitable examples. For instance, I have just given you the result of a series of street widenings and extensions within a goodly area of the congested and most valuable section of an American city. New York abounds with examples of the improvement to property, its rise in value, and a consequent increase of the taxable basis by the extension of the subways. In a report of the Board of Park Commissioners of Kansas City for the year 1910, there were some most interesting and instructive data regarding the increase of land value due to boulevards. I make the following quotation:

¶INCREASE IN TAXABLE VALUES *is much more than the cost of land and construction necessary for carrying out proper civic improvement plans.*

"The figures given in this report, collected by the board's accountant, show the powerful influence which the establishment of the boulevards has had upon land values. On Benton boulevard, upon which the abutting property has responded in a less degree in increments of value than on any other boulevard of the city, it is shown conclusively that the increase in value has been more than 183 per cent. since the establishment of the boulevard, and that after deducting the cost to the property owners of every class of improvements with which this frontage has been assessed, and also deducting the average increase of land value thruout the entire district, which includes increments due to this and other park improvements in the same district, we have a clear net profit, demonstrably due to the boulevard, of approximately 44 per cent. But upon other boulevards, notably Armour, Gladstone, Linwood, Gillham Road and The Paseo, the land gain has been from 200 to 500 per cent., the greater portion of it being directly attributable to the establishment of the boulevards."

And so in various municipalities you will find concrete examples tending to show even to the most sceptical that city planning pays in dollars and cents as well as in the general comfort and living conditions of the citizens.

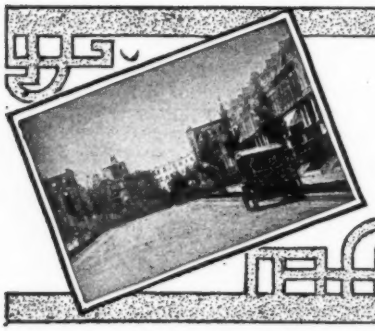
Unfortunately we have no good examples of the results of excess condemnation. This method for the improvement of our municipalities is thought by some of the best experts in city planning to be the real key which will give to American cities a method and stimulus for large neighborhood improvements. Mr. Andrew Wright Crawford, who is intimately associated with the National Conference on City Planning, has given a good deal of study to this subject, and I think his published discussions on the matter are well worth the reading for those interested in civic improvements. Your committee, I note, made reference to excess condemnation in its report. I think all those who have given the matter any attention at all are highly in favor of adopting excess condemnation. But to put it into effect in most cities we will need additional and different kind of legislation. Europe has done wonders in excess condemnation, Germany being probably to the forefront in carrying out such principles. But to Americans interested in the subject, the form and methods adopted in England would probably appeal more strongly than would the methods adopted on the continent. London has issud a most interesting report on the creation, by excess condemnation, of the King's way. You will find this good reading and I think some of the ideas you will find possible to adopt in your plans for Louisville. We shall, of course, have to modify to a great extent the methods which the English adopted, but I can see no good reason why we should not begin to strive to obtain this much needed power in civic condemnations.

¶STREET TREES *and cross sections and like details are essential parts of civic beauty plans for they reach all streets and make them conform to the special beautifying features of parks, places and boulevards.*

Do not forget the details in your city planning. You must never lose sight of the importance of parks and boulevards nor must you forget the importance of the planting of trees along your streets. Within the past few years the progressive American cities have given much attention to forestry departments. The results in many communities have been most gratifying. Washington, of course, is almost ideal in this line. In Baltimore we are on our second year in this work. I do not mean, of course, that previous to this time trees were not planted on city streets, but two years ago we had prepared new legislation and created a separate city department to care for all matters pertaining to the planting, preserving and caring for street trees. The department has been a great success and each year will show more clearly the wisdom of our move. I hope you will see your way clear in Louisville to devote a good deal of time to this great adjunct for the beautifying of your city.

Still another detail which I think you would do well to keep constantly in mind in your future planning for Louisville is that of the cross-sections of streets. Baltimore, following the custom on vogue in many of our older cities, for many years constructed its streets along a general rule of thumb procedure, whereby one-fifth of the total width between building lines was used for each sidewalk and the remaining three-fifths wa sdevoted to the roadway. On some streets this proportion and allotment figured out very well, but on others it was decidedly bad and totally inappropriate, for it entailed the paving of a roadway much too wide for the needs of the traffic. Now, however, we have gotten away from such a poor method, or, rather, lack of method, of procedure and we now endeavor to adjust our cross-section to meet the demands of the thorofare in question. This is, of course, all a very simple matter, but I mention it as simply one of numerous details requiring attention in order to get the best results in your efforts at city planning.

I realize in the talk I have been giving that I have not laid as much stress as one might have thought proper on what I mentioned in the first place, that is, a topographical map as a basis for good city planning. But I have allowed myself to drift from the subject principally for the reason that from the nature of your profession I know full well that you do appreciate the absolute need of such a map in all forms of city planning, and I have thought it little use to dwell on the importance of something which you know yourself much better than I could possibly make known to you.



MISCELLANEOUS

An Aquatic Capital

The photograph on the front cover page shows the city of Brunei, which is the capital of the state or province of Brunei on the Island of Borneo. All the houses in the city are built on slender piles made from the Nibong palm, driven in the bed of the Limbang river, which evidently does not vary greatly in stage. It will be noted that the islands and the banks of the river are heavily wooded and are apparently not inhabited, the people preferring to locate their houses over the water.

The inhabitants are Malays, Kadayans, Orang-Buskits and a few Muruts, whose business is mainly trading with tribes living in the interior of Sarawak and British North Borneo. Their manufacturing industries are brass working, in which they are very skillful, and weaving cloth among the women. Agricultural activities are mainly limited to the growth of sago and rice in the valleys nearby.

A hundred years ago this city was the headquarters of the Borneo pirates and a center for the slave trade.

The municipal problems of such a city are many of them much simpler than those of a city on land.

Municipal Four Per cents at Par or Better

On November 9, 1914, the city of Philadelphia, Pa., sold $825,000 of four per cent. bonds over the counter at par before 11 o'clock of the first day of the sale, and when the offering was increased to $1,125,000 it was all sold within ten days, without any aid from banks. This repeals the city's experience of May 1, 1913, when an offering of $3,500,000 of four per cent. bonds was quickly taken and the offering was increased to $4,125,000 to meet the demands of purchasers. These sales are of part of an authorized issue of $7,000,000 of bonds for public improvements.

In July $1,500,000 was offered for competitive bidding and was sold at about 102.1 to 102.2.

The city of Indianapolis did not find the retail sale of bonds successful, but placed one issue of $63,000 at a bid netting 3.99 per cent. interest.

That contractors and material men are anxious for work is shown by the report that at a letting for a small water works plant in northern Indiana there were 86 bidders present and 110 bids were offered requiring about four days to tabulate and compare to determine the successful contractors.

Lecture Courses for Health Department Employes

The department of health of the city of New York has organized series of lectures on sanitary science for its employes in four courses: For medical inspectors and other physician employes, 18 lectures; for lay food and sanitary inspectors, 24 lectures; for hospital nurses, 60 lectures; and for field nurses on infectious diseases and child hygiene, 20 lectures. All the lecturers give their services gratuitously.

Lectures can be obtained by organizations outside of New York on application to the Lecture Division of the Bureau of Public Health Education, Department of Health, 139 Center street, New York. It is understood that there is no charge for these lectures, tho all expenses of the lecturer and stereopticon, if used, should be paid.

Technical Schools

The University of Illinois maintains ten research fellowships in its engineering experiment station, open to graduates of approved American and foreign universities and technical schools. Appointments must be accepted for a period of two years and holders receive $500 a year. Half time is spent in the station and half time may be spent in graduate study leading to master's degree. Four vacancies occurring next spring will be filled in March from applications made during January, 1915.

The educational institutions in Cambridge, Mass., at the request of Mayor Good, have appointed advisors for the city on matters of taxation. Harvard University appointed Prof. Charles J. Bullock, a prominent authority on economics, and the Massachusetts Institute of Technology has appointed Prof. Chas. M. Spofford, head of its civil and sanitary engineering department.

The second annual short course in highway engineering of the University of Illinois will be given January 11 to 23, 1915. Several state highway engineers, professors, county superintendents of highways, township highway commissioners and road experts are on the list of speakers. Afternoons will be spent in laboratory demonstrations in testing materials, mixing concrete, etc.

"The Analysis of Coal with Phenol as a Solvent," by S. W. Parr and H. F. Hadley, has just been issued as Bulletin No. 76 of the Engineering Experiment Station of the University of Illinois.

American Road Builders' Convention

The fifth American Good Roads Congress and sixth Good Roads Show held by the American Road Builders' Association at Chicago, December 14 to 18, was well attended and both were most interesting and instructive. The distance apart of the two attractions interfered somewhat with the attendance at both, those having special interest in one finding it difficult to attend the other. The registration at the road show seems to have been about 1,500, which by no means measures the attendance, and the total registration was estimated as approximately 4,000.

The Congress was addressed by state, county and city highway commissioners from Wisconsin, Illinois, Ohio, New Jersey, New York, Colorado, Ontario, Arkansas, Pennsylvania, Connecticut, Massachusetts, Kentucky, Indiana, Iowa, Maryland, Michigan, New Mexico, Kansas, West Virginia, Louisiana, North Carolina, Maine.

The discussions covered all branches of the road problem; construction features, such as dimensions, foundations; organization, of department and divisions; traffic tendencies, development and regulation; machinery of construction and maintenance; brick, concrete, wood, stone, bituminous, earth and gravel surfaces for roads and bridge floors, standards of specifications and construction, legislation, convict labor, dust prevention and street cleaning.

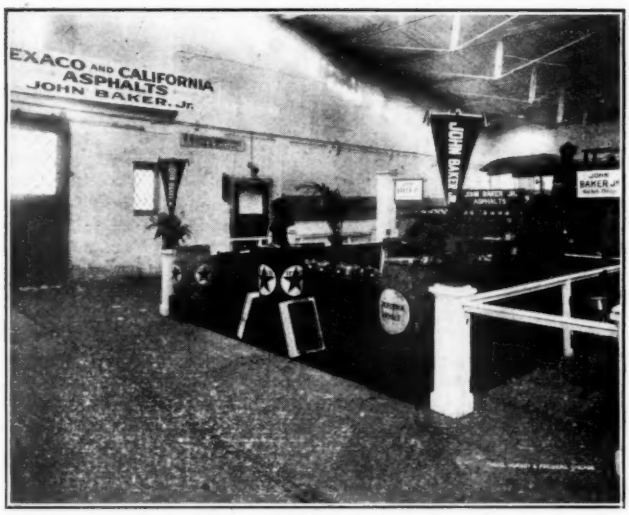
About 125 manufacturers and dealers in road machinery and materials were represented by exhibits, many of them being handsome as well as interesting and instructive. Six photographs of exhibits are shown in the accompanying cuts, which with their titles are self-explanatory.

The educational features of the show were located about a small park and boulevard constructed in the center of the arena at the main entrance to the building. The "boulevard" was paved with sample sections of various pavements including Aztec asphaltic concrete of the U. S. Asphalt Refining Co., brick and creosoted wood block with Sarco filler and concrete surfaced with Sarco asphalt of the Standard Asphalt and Rubber Co., asphalt macadam and brick pavement with Standard asphalt and filler of the Standard Oil Co., asphalt macadam using Bermudez asphalt and asphaltic concrete paving using Trinidad lake asphalt of the Barber Asphalt Paving Co., Warrenite and bitustone pavements of Warren Brothers Company, Tarvia filled macadam with granite and limestone wearing surfaces of the Barrett Manufacturing Co., concrete of the American Portland Cement Manufacturers' Association, wire-cut-lug brick of the Dunn Wire-Cut-Lug Brick Co., Kreolite and hex wood blocks of Jennison-Wright Co., creosoted wood blocks of the U. S. Wood Preserving Co., Kettle River Quarries Co., Chicago Creosoting Co. and Ayer and Lord Tie Co., granite blocks of the Wisconsin Granite Co. and tarvid of F. J. Lewis & Co.

A boulevard lighting system and street signs of the Enamel Sign Co. of Chicago, added to the general beauty of the exhibit. The exhibits of the Chicago street department, the U. S. Office of Public Roads and highway commissions of several states and cities surrounded the boulevard.

Materials of construction and machinery were separated into the two groups. Exhibitors of materials included asphalts by Barber Asphalt Paving Co. with a moving picture show, see one of the accompanying photographs; U. S. Asphalt Refining Co.; John Baker, Jr., with Texaco and California asphalts, as seen in one of the photographs; Bitulithic by Warren Brothers Company, as seen in one of the photographs; Tarvia by Barrett Mfg. Co. with a moving picture show; Rocmac by the Rocmac Road Corporation of America; Glutrin by the Robeson Process Co.; brick by The Dunn Wire-Cut-Lug Brick Co., with their daily carnations for every visitor, and the National Paving Brick Manufacturers Association, both shown in one of the accompanying photographs; concrete building and road reinforcement and joint protectors by Trussed Concrete Steel Co., as shown in one of the photographs; as-

Trussed Concrete Steel Company, Detroit, Mich. Concrete reinforcement curb and joint protectors and waterproofing.



John Baker, Jr., New York. Texaco and California Asphalts.

Warren Brothers Company, Boston, Mass. Bitulithic, Bitustone and Warrenite pavements.

EXHIBITS AT CHICAGO ROAD SHOW.

phalt paving plants by F. D. Cummer & Sons Co., by photographs and booklets; cement by Universal Portland Cement Co.; creosoted wood Kreolite and Hex blocks by Jennison-Wright Co.; Sarco asphalt for asphaltic concrete, expansion joints, filler for block pavements, wearing surface for concrete pavements, etc., by Standard Asphalt and Rubber Co.; inspection facilities for construction and materials by Robert W. Hunt Co.

In the machinery exhibits the Koehring Machine Co. had a prominent place with their paving mixers No. 6 and No. 16, one of them shown in an accompanying photograph; the Utility Road and Farm Machinery Co. with their Clark grader and trenching machine, Kelly-Springfield Motor dumping trucks; Austin-Western Machinery Co. with their new gasoline road roller; Erie Machine Shops with their new Erie steam roller; the Jaeger Machine Co. with their paving mixer; Knox Motor Co. with photographs and booklets regarding the tractor; Marsh-Capron Co. with their concrete machinery; Steel Protected Concrete Co., with their Wainwright steel protected curb; Turbine Sewer Machine Renovating Co., with their sewer cleaning machinery and photographs of results.

Limitations of space prevent completion of the list of which the above are representative.

Personal Notes

Arthur W. Dean, M. Am. Soc. C. E., chief engineer, Massachusetts Highway Commission, Boston, Mass., on December 3 delivered a lecture on "Specifications for Sizes and Physical Properties of Broken Stone," before the graduate students in Highway Engineering at Columbia University.

Sumner R. Church, manager, Research Department, Barrett Manufacturing Company, New York city, on December 7 delivered an illustrated lecture on "The Essential Physical and Chemical Properties of Creosote Oils for Wood Blocks," before the graduate students in Highway Engineering at Columbia University.

A. W. Dow, chemical and consulting paving engineer, New York city, on December 6 delivered an illustrated lecture on "Details of Construction of American Wood Block Pavements," before the graduate students in Highway Engineering at Columbia University.

George W. Tillson, M. Am. Soc. C. E., consulting engineer to the president of the Boro of Brooklyn, New York city, on December 11 delivered an illustrated lecture on "European Wood Block Pavements," before the graduate students in Highway Engineering at Columbia University.

George Prentiss Robinson, C. E., has retired from the office of city engineer of Santa Barbara, Cal., where he has had charge of extensive paving improvements, a 2,000-foot sea wall and several bridges. He returns to the general practice of civil engineering at 849 N. Mariposa Ave., Los Angeles, Cal.

John G. Evans has joined the sales force of the Marquette Cement Mfg. Co., at their Chicago office.

Technical Associations

The sanitary section of the Boston Society of Civil Engineers will meet January 6 and hear talks on "Diatoms" by Prof. Geo. C. Whipple, of Harvard University; F. F. Forbes, superintendent of water works at Brookline, and others. S. E. Tinkham, secretary.

The engineering section of the American Association for the Advancement of Science, meeting in the Engineering Building of the University of Pennsylvania, in Philadelphia, has a long program of papers for Wednesday and Thursday, December 30 and 31, which sustains the reputation of this organization for excellent work, tho it is evidently impossible to read all the papers or to discuss any considerable number of them in the time allotted.

The American Wood Preservers' Association will meet January 19 to 21, at Congress Hotel and Annex, Chicago, Ill. This is a working association whose value is demonstrated to engineers generally by the annual volume of proceedings. Membership is open to all engineers, professors, editors, producers of materials and others interested in the work covered by the title of the organization.

The twelfth annual dinner of the Municipal Engineers of the City of New York will be held January 16, at the Hotel Savoy, at 7 p. m. Geo. A. Taber, secretary.

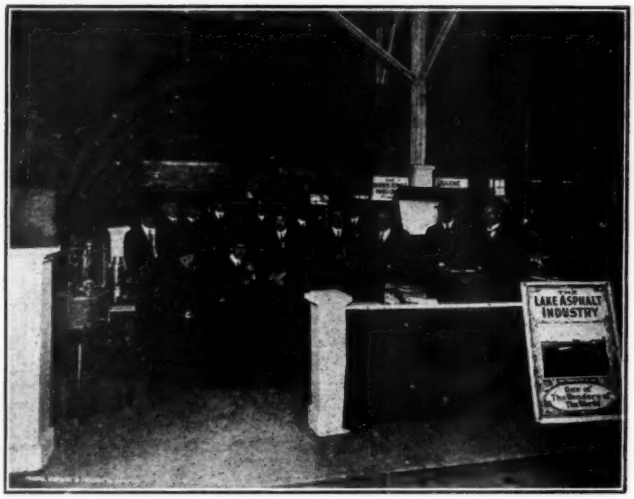
The second National Foreign Trade convention, to be held in St. Louis, January 21 and 22, has for its objective greater prosperity thru greater foreign trade. Hon. W. C. Redfield, U. S. Secretary of Commerce, and John Basset Moore, formerly counselor of the U. S. Department of State, will open the convention. Authoritative papers by leaders in the business world, constructive discussion by delegates from all parts of the country, and ways and means for the smaller manufacturer and merchant to engage in foreign trade are the features of the program.

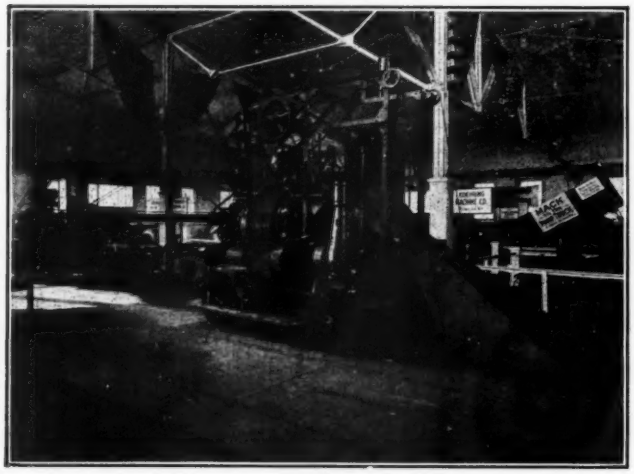
The special railroad rates for the Panama-Pacific and the Panama-California expositions at San Francisco and San Diego go into effect March 1, and are on the basis of $50 for the round trip from Missouri river points.

The Engineers' Club, of Dayton, O., be-

Dunn Wire-Cut-Lug Brick Co., Conneaut, O., and National Paving Brick Manufacturers' Association, Cleveland, O. Brick pavements.

Barber Asphalt Paving Company, Philadelphia, Pa. Trinidad Pitch Lake and Bermudez lake asphalts, asphalt pavements and bituminous surface roads.





Koehring Machine Company, Milwaukee, Wis. Concrete mixers and distributers.

EXHIBITS AT CHICAGO ROAD SHOW.

gan its life practically on May 14, 1914, in a handsome clubhouse at Second and Madison streets, and is a new idea for a technical association outside the largest cities. It has already made itself felt in the city, and its influence can be extended indefinitely. The club will be the host of the American Society of Municipal Improvements at its convention, to be held in Dayton, October 18-22, 1915.

At the annual meeting of the American Society of Mechanical Engineers, held in New York, the sessions of December 3 were devoted to engineering in the administration of a city, with papers by prominent officials in the engineering departments of the cities of New York, Philadelphia, St. Louis and Cleveland, and others.

The American Society of Engineers, Architects and Constructors, at its monthly meeting, held in the United Engineering Societies Building, on Thursday, December 10, passed the following resolution: "That in view of the complex nature of modern engineering and architectural construction, which demands practical knowledge far in excess of the limits of one man, it is desirable, in the interests of our cities, that their municipal authorities should at times call in the assistance of experts for consultation with their own engineers."

The third annual meeting of the Montana Institute of Municipal Engineers will be held in Helena, Mont., January 18-20. Carl C. Widener, secretary, Bozeman, Mont.

At the annual meeting of the Brooklyn Engineers' Club J. S. Langthorn was elected president; G. Laurence Knight, vice president; Joseph Strachan, secretary; W. W. Brush, treasurer.

The Ohio Engineering Society will hold its thirty-sixth annual meeting January 20-22, in Brown Hall, Ohio State University, Columbus. The program includes papers on inclosing a stream thru Mansfield, by C. L. Bradley; an experiment in resurfacing a concrete road, by F. J. Stinchcomb, county surveyor, of Paulding; wire-cut-lug brick, by W. C. Perkins; culvert design, by P. K. Sheidler, of the state highway department; brick roads, by D. Moomaw, road engineer of Cuyahoga county; a recent public utility franchise, by Charles C. Brown, of MUNICIPAL ENGINEERING; the relation of the engineer to plans and work, by Will P. Blair, of Cleveland; the National Road, by J. T. Voshell, of the U. S. Office of Public Roads; the state highway department, by James R. Marker, commissioner; the Columbus sewage, garbage and water treatment plants, by Prof. F. H. Eno. John Laylin, of the state highway department, is secretary.

At the annual meeting of the New England Water Works Association, Desmond Fitzgerald will show and describe some travel lantern slides, and the report of the committee on filter statistics will be made and discussed. The president, Frank A. McInnes, will deliver his annual address and officers will be elected. The meeting will be held at Hotel Brunswick, Boston, Mass., January 13.

Publications Received

Water Supplies; Their Purification, Filtration and Sterilization; a handbook for the use of local and municipal authorities, by Samuel Rideal, D. Sc., fellow of University College, London, and of the Institute of Chemistry; public analyst for the metropolitan boro of Chelsea; and Eric K. Rideal, B. A., Ph. D., with numerous illustrations and tables. American publishers, D. Appleton & Co. Cloth, 274 pp.

Report of the fifth annual meeting of the Commission of Conservation of Canada, held at Ottawa, January 20, 21, 1914. Clifford Sifton, Chairman, Ottawa, Can.

Graphic Methods for Presenting Facts, by Willard C. Brinton, is one of the volumes of the Works Management Library, published by the Engineering Magazine Company, New York. Cloth, 370 pp. $4.

Civil Service Examinations

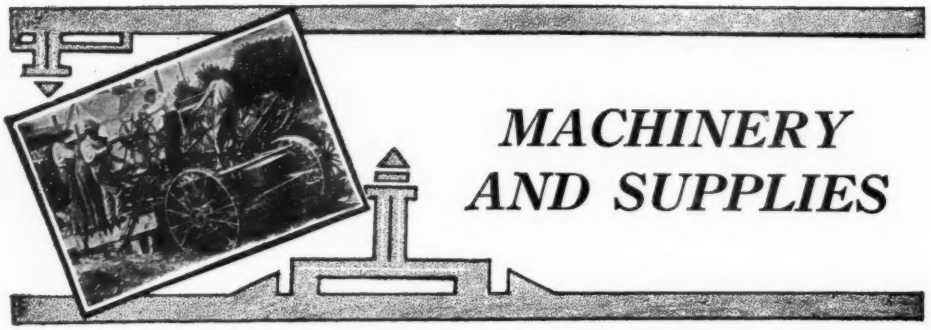
The United States Civil Service Commission will hold examinations at the usual places, as follows:

February 2: Sanitary engineer in Public Health service in the field at $2,500 a year.

February 3: Physical laboratorian in New York navy yard, at $3.04 a day; copyist marine engine and boiler draftsman in Norfolk navy yard, at $2.80 a day; copyist electrical draftsman in New York navy yard, at $3.28, and in Philadelphia and Puget Sound navy yards, at $3.04 a day; copyist ordnance draftsman in Washington navy yard at $2.80 a day; civil engineer student in the Office of Public Roads, at $720 a year; temporary topographic and under Geological Survey during field season, at $40 to $75 a month.

February 3, 4: Marine engine and boiler draftsman in Philadelphia navy yard, at $5.04 a day; electrical draftsmen in nevy yards and establishments, at $3.52 to $5.52 a day; ordnance draftsman in any U. S. navy yard or establishment or in Washington, at $3.28 to $5.04 a day; structural steel draftsman at Newport naval station, at $4 a day.

February 4, 5: Junior topographer in Geological Survey, at $720 to $1,200 a year.



MACHINERY AND SUPPLIES

Street Signs and Sign Posts

In the December number of MUNICIPAL ENGINEERING, vol. xlvii, p. 482, is an article describing and illustrating very simple and economical as well as low priced designs for posts for street signs of various sorts and the enameled signs used on the posts. The paragraph giving the name of the company was lost from the copy for the article and so due credit was not given for the supply of a design which only needed to be known to become popular for general road work.

The Enameled Steel Sign Co., 222 North State street, Chicago, Ill., can supply the signs and will send on request a booklet giving full information about them and the prices at which the various designs can be furnished.

New Road Asphalt Paving Plant

R. L. Davis, contractor, Tampa, Fla., has just purchased a Cummer road asphalt paving plant to be used first at Tarpon Springs, Fla., for sand-asphalt roads. After completing this contract it will be shipped elsewhere for laying asphalt macadam.

This plant is especially adapted for this class of road work, because it consists of three units, power, asphalt kettles, drying and mixing; and each unit is mounted on its own trucks with broad wheels, making the complete plant easily moved along the road, and kept up with the work.

The capacity of this plant is about 1,000 yards of 2-inch sand asphalt topping per day, or the equivalent of sheet asphalt, asphalt macadam or Topeka mix.

The plant will immediately be put into commission. This is the fifth plant of this type to be shipped South this season for sand asphalt roads and sheet asphalt, asphalt macadam and Topeka mix pavements. They come from the F. D. Cummer & Son Co., Cleveland, O.

The plant is designed for moving along the road, to be kept up with the work, or to be jacked up and used in the following manner: When moved along the road, the mixture is taken away by means of wheelbarrows, and when it is jacked up, the mixture is taken to the work on the streets or roads in wagons or auto trucks.

There are also many of these road plants in operation in the East and Middle West.

A Damp Resisting Paint

Antkawa damp resisting paint is an indestructible compound of water-resisting and alkali-proof materials scientifically combined, which when applied to the inner walls of brick, stone, cement or tile, dispenses with furring and lathing.

Being plastic in its nature, it expands and contracts in unison with the surface to which it is applied and permits scratch coat of plaster to absorb sufficient so as to form a permanent bond between the wall and the plaster.

Applied on the interior of walls it seals them, making an air-tight, heat and cold insulating barrier, thereby reducing the radiation necessary for the heating of the building.

There being no space between wall and plaster, vermin are eliminated and a sanitary fire-proof construction is secured which not only economizes in space, but cost as well.

Antakwa prevents the alkali and saltpeter from penetrating the plaster and staining the decorations.

For plastering direct to Antakwa damp resisting paint, the surface should be clean and dry and masonry pointed up to a reasonably smooth condition. Paint should be applied with a stiff brush, care being taken that no minute pinholes are left uncovered. After application of a good continuous coat a second or retouch coat is given to bring the surface to a uniform blackness. Plaster can be applied twenty-four hours after.

A recent problem of this nature was stated as follows to The Antakwa Company, 403 Chamber of Commerce build-

ing, Chicago, Ill., the makers of the paint:

"We have about 50,000 square feet of faced brick on the interior walls of our new pumping station, the brick being a hydraulic dry pressed brick, buff in color. A great amount of efflorescence showed on the surface of this brick, all of which has recently been cleaned off, but in order to prevent a recurrence of this discoloration we are desirous of coating the brick with some transparent, colorless preparation which will prevent any exudation in the future.

"Understanding that you are manufacturers of the material to be used for the purpose indicated, I would be pleased to hear from you with full particulars regarding your product, giving the price, the amount required, and the guarantee which you would give with said material to prevent any further discoloration on the brick wall. I would also be pleased to know whether you would prefer to do the work yourself or whether the material can be applied by any skillful painter."

The application of Antakwa in two coats, which can be made by any good painter, will cure the difficulty at a cost of about 1 cent a square foot of wall, the covering capacity of Antakwa being 125 to 150 square feet per gallon for two coats.

The paint has been used in many hospitals, schools, apartment houses, theaters, office and college buildings for waterproofing and damp-proofing purposes, one large academy building requiring 5,750 gallons, tho 600 to 1,200 gallons is the usual amount applied in buildings of the classes named.

The Antakwa Company will give full detail as may be desired.

See America First New Year's Greeting

We are wishing you a pleasant journey through the coming year—

A journey that shall not be marred by skidding—

A journey in which there may be few rough spots—

A journey in which you may have Safety First, last and all the way—

A journey which may enable you to See America First in the galaxy of nations—

First in prosperity, First in Peace, and First in Honor—

A journey that shall bring you all the comfort, all the safety and all the steady going that accompany Goodrich Tires—

A journey during which every day may be a continuous round of pleasure—

Just as each Goodrich Tire is.

And may all your ventures prove to be for the Best in the Long Run.

The B. F. Goodrich Company,
Makers of Everything that's Best in Rubber.

A Safe and Tight Manhole Cover

The accompanying cut shows the D. and D. safety cover for manholes and its construction, so as to demonstrate that the design is one which prevents all rattling or dishing of manhole covers under street traffic. The lugs shown in the cut fit into each other very snugly and prevent any noisy motion.

The South Park Commissioners of Chicago have installed the covers on some of the South Side boulevards, made of the Chicago city street manhole size, weighing 540 pounds complete. They are also in use by the electrical department of the city of Chicago and by the water department. The dimensions of the 540-pound cover are 24-inch diameter of opening, 36-inch diameter of bottom flange.

Except for the more perfect fit of the lid, the cover is in all respects the same as the ordinary manhole required by Chicago specifications. The advantage is in the tightening and wedging of the lugs on the lid upon the lugs on the inside of the manhole ring.

The lid is as easy to remove as the ordinary manhole cover lid, because the lugs are so constructed that frost or dirt do not affect the removal.

The difference in difficulty of making the castings makes the price a little higher than the ordinary cover, but its safety from tipping and the absence of rattling more than make up for the small difference in cost. Cities adopting it will at once appreciate its good points. Coalhole covers, water caps or any like manhole covers are safer if of this design.

The cover is put on the market by Wm. E. Dee Company, Stock Exchange building, Chicago, Ill.

Steam Melting Asphalt Plant

Some years ago, certain advanced asphalt experts discovered that asphalt, after having been overheated, lost the greater part of its usefulness.

The Merriman plant was equipped with steam coils to prevent this destruction, and for a period of ten years, no asphalt pavement that was mixed by this plant has either gone to pieces totally, or in patches, on account of burned asphalt having been used in the mix.

It has demonstrated its capacity of 2,800 square yards of 2-inch sheet asphalt top in ten hours and a corresponding proportion of asphaltic concrete. The mixer is the equivalent of 12 cubic feet. All power transmission is protected from the fine sand and the cost of repairs has been very low as a consequence.

The East Iron & Machine Company, of Lima, O., will furnish any further information regarding this plant.

Watson Corrugated Culvert Patent Valid

The large number of manufacturers of corrugated culverts in the United States operating under the Watson patent, have just been informed by their attorney, Wallace R. Lane, of Chicago, that the United States Court of Appeals for the second Circuit, having final jurisdiction, has just handed down a mandate reversing the lower court and holding the Watson corrugated culvert patent valid and infringed by the culvert installed by a highway commissioner in New York. In brief, the court holds:

"The Watson patent has been so thorolly discussed in the opinions of the District Court and of this court, that it will serve no useful purpose to repeat in detail what is there said regarding the patent and the disclosures of the prior art. The patent is for a corrugated metal culvert. It is unusually plain and simple.

"In brief,, the claim is for a sheet metal culvert composed of connected cylindrical sections having circumferential corrugations extending to the extremities of the sections. Each section terminates at one end in a flared and at the other end in a contracted portion of a corrugation, so that two sections may interlock, the ends being held in place by bolts or similar means. The corrugations greatly strengthen the culvert and the doubling of the corrugations at the joints braces and adds stability in the structure.

"In short, the patented culvert is cheap, strong, durable, easily transported, quickly laid down and easily repaired.

"We cannot believe that the man who gave such a structure to the world should be denied the title of an inventor.

"The fact that Watson, during the early years of his patent was almost invariably repulsed by those interested in the art because they thought his device empirical, inefficient and perishable, is persuasive to the conclusion that his improvement was not obvious.

"In view of the phenomenal success of the patented pipe after the public became aware of its advantages and the strength and durability which it has developed after years of trial, we are of the opinion that any doubt as to patentability should be resolved in favor of the patent.

"The practical and commercial success of the Watson culvert is so clearly shown that we find it difficult to believe that a mere mechanic could have produced a culvert which has so revolutionized the art, a culvert which has shown a durability which no one at the time of the invention thought possible.

"We have here not only the circumstances that the new device has commended itself to the public and gone into extensive use. This sometimes happens because of judicious advertising and clever business methods.

"The early history of the patentee's experience is illustrative. For years after the issue of the patent he labored unsuccessfully to introduce his culvert. The persons whom he urged to try his device, persons engaged in road building and under-draining, declined to do so because it seemed to them very doubtful whether it would endure, and opposition was overcome only after he had actually built a few culverts and demonstrated their capacity to remain efficient after years of use. This circumstance indicates that simple tho it is, the Watson culvert is a device which would not have suggested itself to the ordinary road-builders.

"Infringement is clearly shown; the two structures are almost identical and the only differences are of form and not of substance. The defendant passes the rivets thru the metal at a point further from the ends of the section by less than an inch than in the complainant's structure. The difference is trivial and nothing functional is accomplished thereby.

"The decree is reversed with costs and the cause is remanded to the District Court with instructions to enter a decree for the complainant in the usual form."

The manufacturers of corrugated culverts under this important patent, including the National Corrugated Culvert Mfg. Co., of Middletown, O., make them out of Armco American ingot iron.

Waterproofed Coatings of Surfaces

Before applying the waterproofed coating the surfaces must be especially prepared that a suitable bond be obtained. In fact, this preparation of surface is most important and many of the past failures in the application of the process may be attributed to the lack of care in this operation.

The proper bonding face is obtained by thoroly roughening, cleaning and grouting the surface. The wall or floor slab must be saturated with clean water to destroy excessive capillarity, for otherwise the pores of the masonry will absorb a large percentage of the gaging water, together with the finer particles of cement, and the strength and efficiency of the coating be impaired. Particularly in the case of brick walls or floors should the members be thoroly wet down, owing to the great absorptive property of this material. A slight amount of absorption is desired, however, as it assists materially in obtaining the necessary bond.

In the case of concrete walls the entire face is chipped to expose the aggregate, while for brick and rubble the joints are raked and the surfaces roughened. For floors it is highly advantageous to apply the waterproof coating the day following the placement of the concrete slab in order to simplify the bonding operation. When the coating is applied over old concrete floors similar precautions as for walls must be observed.

The cement coating is prepared by an intimate mixture of Portland cement and coarse sand with the incorporation of an Integral waterproofing compound, such as Trus-Con Waterproofing Paste, made at the Trus-Con Laboratories, Detroit, Mich. Proportions of 1 part cement to 2 parts sand are best adaptable for the purpose, as mixtures considerably leaner than this are too porous, whereas coatings of richer mixtures have a tendency to crack under temperature changes.

For waterproofing vertical surfaces the coating is applied in two coats, scratch and finish, giving a total thickness of ¾ to 1 inch, while for horizontal surfaces the coating is placed in one operation 1 to 2 inches in thickness. The second coat for vertical surfaces should follow the first at an interval not exceeding eighteen hours under normal conditions, as after final set has taken place, the pores of the waterproofed scratch coat, being negative in capillarity, tend to repel the grouting particles of the finish coat, resulting in a lack of adhesion.

Pueblo's New Street Sprinkler and Flusher

The city of Pueblo, Colo., has purchased from the Kissel Motor Car Company a motor-driven street sprinkler and flusher that is, in many particulars, quite different from anything of the kind heretofore produced.

The tank is mounted on a six-ton chassis, the largest made by the Kissel company. The car, loaded and fully equipped, weighs about twelve tons and carries 1,500 gallons of water. It is designed to do away with at least fourteen horse-drawn rigs. A letter regarding the tests made of this vehicle says, among other things:

"The water pump, when used for flushing, requires about 8 horsepower at 50

KISSEL *street sprinkler and flusher in use in Pueblo, Colorado. Sprinkler heads in front; flushing nozzles in rear of front wheels.*

LEVERS *of Kissel street sprinkler and flusher, for controlling motor, pump, each sprinkler head and each flushing nozzle.*

pounds pressure, but we find the motor picks up this load, together with that of the car, in a surprisingly easy manner. We are very much pleased with the rig as a whole."

Power Traction Trench Tamper

The P. and H. trench tamper is not only an efficient tamper of material to fill excavations, but is equally efficient as a cutter of asphalt and a breaker of concrete.

Some of the features of the machine are the following:

1. The wheels are carried on stub axles of steel that may be raised or lowered 5 inches, on either side, from the center of the upright members of the main frame to which they are attached. This device makes it possible to keep the machine level tho one wheel be on ground 10 inches higher than the other.

2. The axles of the tamper are carried out far enough to allow of widening the wheel tread 12 inches on either side, 24 inches in all. The minimum tread is 4 feet 8 inches and the maximum is 6 feet 8 inches. It is not necessary to move both wheels unless desired, as it may be necessary to leave one wheel close to the trench on account of narrow berm. This may be regulated to suit conditions and the wheels may be placed at any point within the range of adjustment.

3. The tamping head moves across the machine on a solid steel runway provided for it. The weight of the entire machine is carried on 6-inch rollers and is evenly distributed. The tamping head is 12 inches wide and has a maximum cross travel of 20 inches, enabling it to actually cover 32 inches of trench. Since it is not necessary to tamp closer than 4 inches to the wall of the trench in most cases, the machine will handle a 40-inch trench. The tamping ram is operated by means of a large segment brought in friction contact with the hardwood ram by spring pressure on a large pulley on the opposite side of the ram. This segment is caused to revolve from 50 to 60 times per minute and, of course, causes a stroke of the ram at every revolution. This stroke has an average of 22 inches travel, and, as the ram and tamping head together weigh 150 pounds, a thoro packing of the earth results. When

it is considered in comparison with hand labor the machine shows its worth very forcibly. It is pointed out that a good laborer with even a 15-pound tamper will not average more than 20 strokes a minute and will hardly ever lift the hammer more than 9 or 10 inches, as compared with the machine's 150-pound ram, 22-inch stroke, 60 a minute and "do it all the time."

4. The traction tamper moves entirely under its own power. The engine is throttle-governed with jump-spark ignition and is water-cooled. A speed of 1 1-3 miles per hour is provided for road traveling, tho this may be varied by changing the engine governor. A feeding speed, ranging approximately from 10 to 25 feet per minute, is provided to furnish a continuous slow movement forward when at work. A suitable reverse is provided for convenient movement of the machine.

It is claimed that the machine will do the work of 8 men in tamping, on the average; of 7 men in cutting asphalt, and of 3 men in breaking concrete. Its average speed of work is 1,080 square feet of tamping per hour, 145 linear feet of asphalt cut or 54.6 square feet of concrete broken up. It operates with one man.

Pawling and Harnischfeger Company, Milwaukee, Wis., are the manufacturers of this labor-saving and efficient machine and will give full detail of actual results and references to jobs on which it has been used.

Gypsum as a Fireproof Material

A very interesting and valuable treatise on "Gypsum as a Fireproof Material," by H. G. Perring, Assoc. M. Am. Soc. C. E., is published by the United States Gypsum Co., 205 West Monroe street, Chicago, Ill., and can be had for the asking. The conclusions of the article, aside from the examples of actual service, may be stated briefly in the following paragraphs:

Analyzing the special features of Gypsum plaster in general, which make the material desirable as fireproofing, we find the following points:

1st. Low heat conductivity is an essential point. In partitions heat is not conducted thru to set fire to furnishings, etc., on the opposite side. In the protection of structural steel work the steel is protected from the weakening action of heat. Many fires attain a temperature of 2000 degrees F. At 1700 degrees F. a steel column can only bear its own weight. The heat penetrates the plaster at such a slow rate that in the fires of ordinary duration the metal would hardly get warm.

2nd. Tests and experiments have failed to indicate any appreciable expansion of plaster under heat action. An inherent quality of all other forms of fireproofing is high expansion, resulting in a tendency of the fireproofing to wreck itself either by buckling, or, in the case of material of tile shape, the cracking off of the tile face. This destructive element does not enter into Gypsum fireproofing.

3rd. Materials of a nature that expand under heat readily contract when water is applied to the heated surface. This contraction is often so severe as to cause the bursting of the material. Plaster partially recalcines under high heat action and the subsequent application of water removes this recalcined portion. Plaster being a fairly soft material is eroded to some extent by water at a high pressure, but plaster fireproofing generally will withstand severe water application, there being no indication of the bursting so common in other materials.

4th. Any material to be used for fireproofing must not burn or support combustion. Plaster is incombustible.

5th. Lightness is essential in fireproofing, as the fireproofing at best is dead load on a building and plays no part in the support of the structure. Plaster is the lightest practical fireproofing material. Its use reduces the load on structural sections and in case of fire makes the building less liable to collapse.

6th. Plaster fireproofing has sufficient strength for use in partitions, column covering, etc., and in fires will stand up reliably against the impact of fire streams.

7th. Plaster is adaptable to any form of construction. Where used in slabs they are readily sawed or cut to fit any desired location and the use of the material in the plastic state will cover any possible condition of construction.

8th. The desirable fireproofing material is one that combines all the fireproofing features with low cost.

It is only by such a combination that the building of fireproof buildings will be encouraged. Plaster is in itself low of cost. Because of its lightness it reduces the load on a building, thus allowing a lessened amount of structural material.

Its lightness makes it more easily handled. Its adaptability, the ease with which it is sawed, etc., makes the construction of fireproofing easy. Trim can be nailed to plaster fireproofing without the use of wood blocks or grounds, saving the cost thereof and omitting combustible material from the building. Plaster blocks or boards are true and even and reduce the cost of plastering to a minimum.

Sidewalk Science

A booklet on sidewalk, curb and gutter construction is issued by the Hotchkiss Lock Metal Form Co., of Binghamton, N. Y., which should be in the hands of every engineer or contractor interested in the construction of such improvements, whether they are users of the metal forms or not, because it so thoroly demonstrates the principles of right construction of concrete work, particularly in walks and curbs. The company will send the booklet, "Sidewalk Science," on request. It is worth sending for also for the many novel ideas in the use of forms for the special constructions so common in connection with private walks, steps, sidewalk, blocks, curb and the like with which it is filled.

An Electric Calculating Machine for Engineer and Contractor

Among the inventions of the past few years there is no one which offers more relief from mere mental drudgery in engineering work than the electric calculating machine. This electric calculating machine puts keys at the beck of the finger tips which enable the engineer to instantly solve all kinds of problems in multiplication, division, addition, and subtraction.

In the accompanying illustration of the Ensign electric calculating machine is shown the working face of the Ensign machine, the motor and drive and tubular stand on which they rest being the necessary but uninteresting part of the detail of operation.

This machine handles multiplication, division, addition and subtraction with amazing rapidity, taking all work up to and including 9 figures by 7 figures and giving the complete result to 20 places.

It operates so rapidly that it will take care of the work of the most speedy operator, and by the use of a series of proof dials, the work may be checked at the time the calculation is made, thus eliminating the need for a second checking of even original calculations.

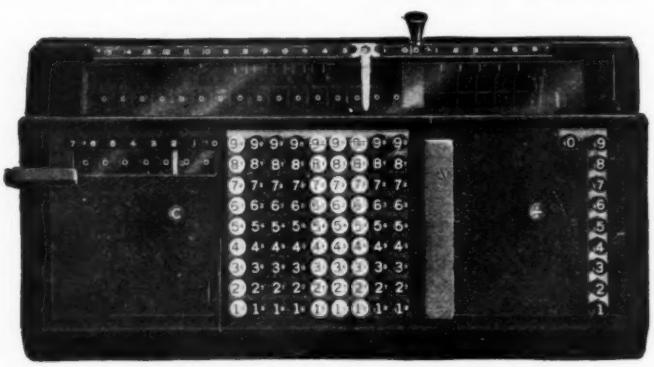
The nine rows of keys are adding keys, addition being performed by merely striking the proper keys—which remain depressed—then touching the adding bar at the right of the keys, which instantly releases the keys and registers the amount or adds it in—the result appearing in the result meter dials, just above the adding keys.

The keyboard is flexible so that errors may be instantly corrected by merely striking the proper keys, as the amounts are not calculated in until the adding bar is struck, in addition, or the proper key in the multiplying keyboard, for multiplication and division work.

The single row of keys at the right is the multiplying keyboard. To multiply you merely depress the proper keys in the adding section representing, say 467, 892, 375, and then depress the proper keys for the multiplier in the multiplying keyboard, say 6, 731, 837—beginning with the right hand figure, the same as if multiplying with pencil and paper—and the moment the last figure of the multiplier is registered in the multiplying keyboard, the result or product (in this case it would be) will appear in the result meter, and the figures of the multiplier (6, 731, 837) will appear in the proof dials at the left of the adding keyboard. The keys previously depressed in the adding keyboard remain depressed. Thus the operator may instantly check back the work to see that the amounts multiplied, or divided, have been properly recorded, and thus know that the work is absolutely correct.

In division work, the quotient appears at the left side in the result meter dials and the proof of the quotient in the proof meter dials.

This feature of proof and ability to in-



KEYBOARD OF ELECTRIC CALCULATING MACHINE.

stantly check all operations is a most important feature, as this enables a user of this machine to save all cost for again checking the work, which in many cases will split the cost of handling all figuring right in two, especially in cost accounting, pay roll work, tabular engineering figuring, estimating, etc., to say nothing of the great speed of the machine, which saves three-fourths to four-fifths of the time over pencil and paper calculation. When the time of a valuable employee or an engineer is involved, the cost of this machine may be easily saved in a very short time.

The "C" key (constant button) when depressed, will lock any constant figure in the adding section, so that repeated multiplications may be made, where the multiplicand is the same for a number of multiplications, by simply pressing the keys in a multiplying keyboard, which represent the figures of the different multipliers.

The Ensign electric calculating machines are all electrically operated, but have automatic control, the motor being instantly cut out the minute the operation is performed, so that little current is consumed and the motor need never be left with current turned thru it.

J. P. Sharpe, western sales manager, 72 West Adams street, Chicago, Ill., will give any further detail desired.

Specifications for Standard Brick Pavements

The National Paving Brick Manufacturers' Association, thru a committee of practical and experienced civil engineers, road builders and manufacturers of paving brick, all of whom have had many years of experience with the building of brick roads and pavements and the manufacture of paving brick, have prepared and published "Specifications for the Construction of Vitrified Brick Street Pavements and Vitrified Brick Highways." In this effort they have endeavored to give the best economical value in the use of paving brick possible; durability, satisfaction in use, ease of traction and a maximum of sanitation.

The association stands ready to render such personal assistance thru its engineering department as may be desired, to the end that the highest and most perfect type of pavement possible will result.

They have made it easy for engineers to inspect good work and to see what results from poor work. They firmly believe in the principles of their manner and method of brick road construction and great public welfare and advantage will follow their use and adoption.

Copies of the latest edition of these specifications will be sent on request by Will P. Blair, secretary of the association, B. L. E. building, Cleveland, O.

Medusa Waterproofing

Medusa waterproofing is a dry white powder and consists of fatty acids, chemically combined with lime. Owing to its extreme fineness it may easily be perfectly mixed with cement in the necessary proportions.

Medusa has now been on the market several years, is the original concrete waterproofing, patented in 1907, and has been used in every part of the world under every condition and in every character of construction in which Portland cement is used.

To render cement work impervious to water a small quantity of the waterproofing is thoroly mixed with the dry cement before the addition of sand and water. For most purposes from 1 to 2 per cent. of the weight of cement used will be found sufficient. This is equivalent to from 4 to 8 pounds of waterproofing 1 barrel of cement. The precise amount to be used must be left to the experience of the user and depends upon the proportion of sand etc., employed, and on the kind of work to be done.

Thoro mixing is of the utmost importance.

Medusa waterproofing is not soluble, therefore after mixing it dry with dry cement, add sand and mix thoroly; then add water slowly until desired consistency is secured. This will prevent the waterproofing being washed out of the mixture.

It is well known that comparatively poor mixtures of cement, sand and gravel or stone are abundantly strong for most purposes. The drawback to these poor mixtures is their porosity, which causes them to absorb water like a sponge. So-called water-tight mortar may be made by using a large proportion of cement or cement and lime, at great cost. We have found that cement with 1 per cent. of Medusa waterproofing, with five parts sand, gives a more impervious mortar than ordinary untreated cement with two parts sand.

Medusa waterproofing does not affect the color, strength, setting or hardening qualities of concrete and when used in proper proportions it will make any concrete work impervious to water and prevent discoloration from rain.

Medusa waterproofing prevents the white efflorescence which so often renders cement work unsightly; also prevents the appearance of hair-cracks on the surface.

Its use in facing mixture gives satisfactory results.

For mortar, plaster and stucco, use 1½ to 2 per cent. mixture; this means 1½ to 2 pounds waterproofing to each sack of cement or 6 to 8 pounds to a barrel. Mix thoroly while dry. This percentage in a mix of 1 part cement and 2 parts sand is recommended for stucco work as well as plaster for waterproofing cellars, reservoirs, water-tanks, cisterns, foundations, etc. For cement floors and roofs it is only necessary to use a 2 per cent. mixture in top or finishing coat.

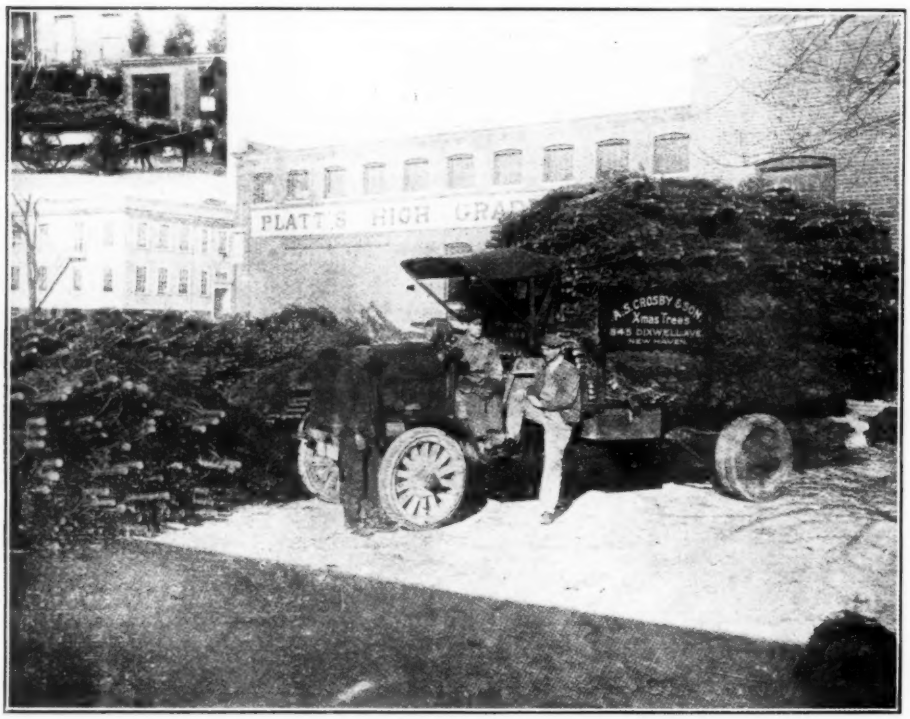
For a wash use 1½ per cent. mixture; this means 1½ pounds waterproofing to each sack of cement, or 6 pounds to a barrel. Mix thoroly while dry. Put a portion of the mixture in a pail, add water slowly and sufficient to make a paint of the consistency of cream. Keep agitated with a stick while in use. The surface must be thoroughly wetted, and the wash applied evenly with a brush. The coating must be thin, or hair-cracks are likely to develop. This mixture will give a waterproof surface.

A new booklet issued by the Sandusky Portland Cement Co. goes into much detail as to the uses of Medusa waterproofing and the success met with by many users.

Auto Truck for Oil Delivery

Some interesting facts regarding the distribution of oil by means of a motor truck comes from the Morlite Oil Company, of Warrensburg, Mo. This company has a 1½-ton KisselKar truck, fitted with a tank of 500 gallons capacity, which is used for the wholesale delivery of kerosene and gasoline to stores thruout the country. There are fourteen of these stores situated from 6 to 20 miles apart, each of which is served once a week. In addition, the truck delivers to twenty-two stores in Warrensburg, these deliveries being made daily.

The delivery equipment of the Morlite company consists of this one KisselKar truck with a crew of driver and helper, while that of a competing firm comprises two-horse teams operated by three men. The horse teams together make on an average of 25 miles per day, working from early morning until late at night and sometimes visiting but one of the country stores. The truck, on the other hand, makes the city deliveries first and then delivers to six or seven of the country stores, returning to the city by four



KISSEL TRUCK *making Christmas tree deliveries in New Haven, Conn.*

five in the afternoon, after covering from 30 to 50 miles. The owners state that the average monthly consumption of gasoline and lubricating oil, respectively, is 100 gallons and 5 gallons.

Specifications for Bituminous Road Binder

The following specifications followed carefully will insure an excellent material for bituminous road construction:

A bituminous road binder in order to be eligible for use under these specifications for the construction of a bituminous surface, of the type herein called for, must comply in all respects with the following practical and established tests for the purpose hereinafter stated.

The bid of each contractor must specifically state the brand of bituminous road binder which he proposes to use. He must give the name, nature and chemical analysis of the material to be used, and where and by whom produced. His bid must be accompanied with a sample of at least one pound of it, properly marked and identified. Bids which do not comply with this requirement will be rejected as irregular.

Test 1—Ductility: In order to demonstrate the cementitious or adhesive character of the bituminous road binder, such binder as used must have a ductility of not less than 50 centimeters at 77 degrees F., according to the District of Columbia standard.

Test 2—Specific Gravity: In order to demonstrate that the bituminous road binder is of an asphaltic and cementitious character, as distinguished from an oily and non-cementitious character, and to preserve the proper balance between its adhesive and cohesive qualities, the specific gravity shall be not less than 1.04 at 77 degrees F.

Test 3—Paraffine Scale: In order to further demonstrate that the bituminous road binder is of an asphaltic and cementitious character, and to insure against the excessive use of non-cementitious materials produced from oils having a paraffine base, the bituminous road binder must not contain more than one-half of one per cent. of paraffine scale, as determined by the Holde method.

Test 4—Penetration: In order to demonstrate that the bituminous road binder proposed to be used is of the proper degree of consistency, it must, when tested for five seconds at 77 degrees F. with a No. 2 needle weighted with 100 grams, have a penetration of at least 12 millimeters and not more than 15 millimeters.

Test 5—Volatilization: In order to demonstrate that the bituminous road binder is of a sufficient stability to insure against loss of consistency and cementitiousness upon being subjected to working heat, it shall meet the following test: When 50 grams of the bituminous road binder are heated in a dish 2¼ inches in diameter for seven hours at 325 degrees F., the loss shall not exceed 3 per cent. and the penetration and ductility of the residue shall not be reduced more than 50 per cent. from its original consistency and ductility.

Test 6—Viscosity: In order to demonstrate that the bituminous road binder is of the proper degree of viscosity, and to demonstrate that such binder has a sufficiently low melting point to insure its penetration to a sufficient depth when poured upon or over the cold stone (or to insure its mixing properly and conveniently with the mineral aggregate), it shall have a float test of not more than five minutes at 150 degrees F., as determined by the float test apparatus manufactured by Howard & Morse, Brooklyn, N. Y.

Test 7—Purity of the Bituminous Road Binder: In order to demonstrate the percentage of bitumen in the bituminous road binder, and in order to regulate the uniformity of this material, it shall be soluble to the extent of at least 95 per cent. in carbon disulphide.

Test 8—Flash Point: In order to insure safety of operation the bituminous road binder must show a flash point (New York State closed oil tester) of not less than 325 degrees F.

Test 9—Durability: In order to demonstrate that the bituminous road binder is sufficiently stable and durable, it must not suffer a reduction in ductility of more than 10 per cent. from its original ductility after it has been incorporated in the paving mixture and extracted therefrom with purified carbon disulphide.

Test 10—Standard: Any bituminous road binder to be eligible for use under these specifications must be in all respects equal in quality to the standard bituminous road binder produced from refined Bermudez Lake asphalt; but whether the binder used is produced from refined Bermudez Lake asphalt or otherwise, it shall not be considered as complying with these specifications unless it complies with each and all of the tests hereinabove specified.

Tire Abuses

"Overloading and overspeeding trucks are prime causes of premature solid tire breakdowns—there are increased expense for the truck user, "time out" for frequent renewals, controversies in regard to adjustments, premature discard of tires

and dissatisfaction with trucks." Mr. S. V. Norton, manager of truck tire sales for the B. F. Goodrich Company, thus sums up his paper on "The Causes and Effects of Overloading and Overspeeding in the Truck Tire Field," before the Motor Truck Club of America.

"The immediate effect of overloading and overspeeding," said Mr. Norton, "is premature tire destruction due to a greater liability to cuts, base separation from excess loads, friction and strain of skidding, weakening of a dual tire if the mate is injured, and overheating with constant disintegration of the rubber. Truck owners naturally desire to get as much work as possible out of their trucks and they may be led to overspeed them. If a truck owner wants to make 'intensive deliveries' he must pay for overspeeding in his tire bills. However, the trucks are often overspeeded without the owner's knowledge, owing to the driver's desire to make a good showing either with the loaded truck or by returning from a trip in quick time. Often drivers speed merely for the sake of the spare time gained

"Overspeeding as a rule is entirely unnecessary, as it need not be due to the absence of a governor or to the power of the truck. Down grades, easy riding, lack of obstacles and extra speed in car tracks all lead drivers to overspeed.

"The causes of overloading are usually due to improper or disproportioned tire equipment or to excessive or poorly arranged loads. Trucks are often overloaded owning to the ignorance of the owner as to what his trucks can safely carry. Loads may be placed too far back or forward on the body of the truck, even tho the loads are within the limits of the tire schedule of carrying capacities.

"Tire equipment may be disproportioned; tires may be too large on one axle and too small on the other, or the body may be too large for the tires. A large body may be allowed to pass unquestioned by a truck agent who is anxious to clinch a sale. This danger may not have been fully explained by the truck salesman when the truck was purchased or the owner may be too occupied to know what is going on. The ignorance or indifference of the driver may also be causes of overloaded trucks.

"One effect of the widespread abuse of tires thru overspeeding and overloading is a stimulation for better tires to meet the present conditions. The defects caused by overloading or overspeeding are usually brought home to the time manufacturer. However, tire makers are meeting conditions by educating all concerned in the proper care of tires, by adopting more rational guarantees, and by improving the tires themselves to meet every possible condition of service."

The B. F. Goodrich Company, for instance, has prepared a series of folders which deal at length with the common causes of tire abuses and remedies for such abuses. These folders, which will be sent to any truck user upon request, cover the following causes of truck tire breakdowns ':'Neglected Cuts," "Overloading," "Running in Car Tracks," "Bad Roads," "Skidding,' "' Anti-Skid Devices," "Wheels Out of Alinement,' 'and "Overspeeding." These valuable pamphlets are distributed from the Goodrich branches in all principal cities, or from the factory at Akron, Ohio.

Johns-Manville Co. Gets Big Pipe Covering Contract

The pipe insulation contract for the new Utah state capitol at Salt Lake City, for which R. K. A. Kletting is the architect, and Jas. C. Stewart Co. are the contractors, was recently awarded to the H. W. Johns-Manville Company.

The high pressure pipes will be covered with J-M asbestos-sponge felted pipe covering, a product made up of laminations of felt composed of asbestos and finely ground sponge. The materials being naturally cellular, they form the basis for the claim that this covering confines more "dead air" cells than any other covering—and therefore possesses higher heat-insulating value.

The heating pipes will be covered with J-M asbestocel pipe covering, which is built up on the arch principle. Sealed air channels run around the pipe, instead of parallel with it, thus preventing the circulation of air and consequent heat radiation.

UTAH STATE CAPITOL *building in which heat-insulation by J-M system is to be installed.*